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THE

MEDICAL JOURNAL OF AUSTRALIA

This Issue is Devoted to the Proceedings of the Pan-Pacific Science Congress.

VOL. II.—10TH YEAR. SYDNEY: SATURDAY, SEPTEMBER 29, 1923. No. 13.

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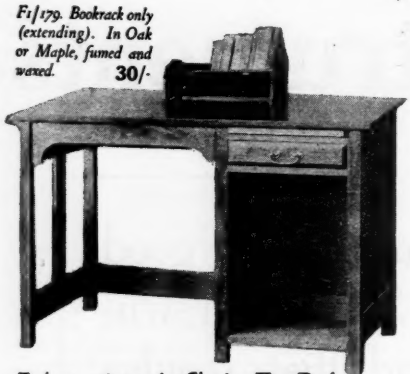

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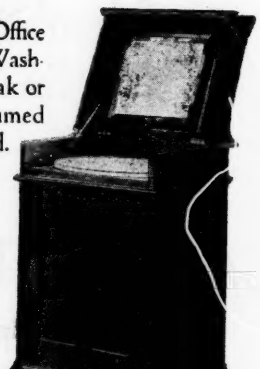

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THE MEDICAL JOURNAL OF AUSTRALIA

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Pan-Pacific Science Congress.

MELBOURNE SESSION.

INAUGURAL PROCEEDINGS.

THE MELBOURNE SESSION OF THE SECOND PAN-PACIFIC SCIENCE CONGRESS was opened on August 13, 1923. The proceedings were marked by an enthusiasm and *camaraderie* which straightway determined the successful issue of the undertaking. The Melbourne Committee had made their arrangements with care and completeness so that an overseas or inter-state member of Congress who did not feel at home, had no one but himself to blame. Delegates were present from Great Britain, the United States of America, Canada, Honolulu, New Zealand, Japan and Formosa, the Philippine Islands, the Dutch East Indies, Burma, British Malaya, Tahiti, Hong Kong, Papua, Fiji and all parts of the Commonwealth. The scene at the headquarters of the Congress in the Melbourne University Union Building on the morning of the opening day was an animated one. Old friends exchanged greeting and introductions were made. There was an air of expectancy and cordiality was rife. The only persons who wore a worried look, were some of the secretaries of sections. Even the press photographers looked happy as they chased inoffensive scientists and made them stand to attention for a moment or two.

The official opening of the Congress took the form of an inaugural meeting which was held in the Assembly Hall, Collins Street. SIR ORME MASSON, F.R.S., the President of the Congress, occupied the chair.

HIS EXCELLENCY THE GOVERNOR-GENERAL was unable to be present on account of illness and in his absence Mr. Bruce, the Prime Minister, read the speech which His Excellency was to have made. His Excellency first of all made reference to the value of scientific research and knowledge in regard to the economic and other problems awaiting solution in the countries bordering on and included in the Pacific Ocean. He also looked for closer understanding and good-will which came from cooperation in scientific matters.

MR. BRUCE on behalf of the Commonwealth Government welcomed the delegates and expressed the hope that their deliberations would be of benefit not only to science but to Australia and the other countries of the Pacific.

SIR ORME MASSON, F.R.S., the President of the Congress, in welcoming the delegates laid stress on the underlying idea of all international conferences which was mutual understanding and sympathy. These alone could insure the peace of the world. He then referred to the benefits which Australia should reap from the Congress, firstly because the Congress was being held in the Commonwealth and secondly because Australia had more to learn from other countries than they had from her. He dealt also with some of the more urgent problems awaiting solution in Australia.

SIR GERALD LENOX-CONYNGHAM, F.R.S., spoke on behalf of the British Government. He conveyed greetings from Cambridge University and the Royal Society of London. In the course of his speech he pleaded for more encouragement and more adequate rewards for the leaders of science.

DR. T. WAYLAND VAUGHAN representing the United States of America said that some of the problems were of such magnitude that they could only be solved by international cooperation. The best way to make people friends was to make them work together on something that they thought was worth while.

DR. JOJI SAKURAI representing the National Research Council of Japan conveyed greetings from Japan and

pointed to the Congress as one method of paving the way to permanent peace in the Pacific.

DR. P. VAN RHOMBURG representing the Netherlands Government conveyed good wishes to the Congress from the scientific societies of Holland. He referred to matters which called for cooperation between the Dutch East Indies and Australia.

THE CONSUL-GENERAL FOR FRANCE also addressed the meeting and expressed regret that the scientific societies of France were not represented.

GENERAL WORK OF THE SECTIONS.

ON August 14, 1923, the members of the various sections settled down to work. In our report of the Melbourne Session the proceedings of the Section of Hygiene alone are included. It is much to be regretted that the attendance of medical practitioners was not more numerous. It is a poor compliment to men who are the recognized leaders in their respective spheres, to bring them from other countries to address a mere handful of people. The plea of ignorance cannot be accepted, for the whole programme was well advertised in the pages of this jounal. It may be that medical practitioners have not yet adopted a scientific outlook, but are content with utilitarian and spoon-feeding methods of instruction. However that may be, what was lacking in numbers was compensated for by the enthusiasm of those who thought that attendance was worth while.

Mine Sanitation.

DR. R. R. SAYERS (the United States of America), the President of the Section of Hygiene, read a paper entitled "Mine Sanitation." Dr. Sayers said that the subject of mine sanitation was such an extensive one that he proposed to confine his remarks to some of its chief phases. He would refer to the safe practices in providing drinking water for miners, to methods of underground sewage disposal and to the effects of variation of mine atmosphere on miners. Dr. Sayers defined pure drinking water as that which did not contain any substances injurious to health. The most satisfactory drinking waters were clear and colourless, had no or very low mineral content, were well aerated and were free from bacterial contamination. Water might be contaminated at its source, during its distribution in the mine or by the users. Contamination at the source might be due to the suspension of small particles of solid matter causing turbidity. Such water was often irritating to the gastro-intestinal tract. Undissolved minerals, such magnesium and sodium sulphate, might have a cathartic action. Unaerated water, though not detrimental to health, tasted flat and was not pleasant to drink. Bacteria were the most frequent source of contamination. Dr. Sayers discussed briefly the various methods of purifying water. Distilled water was the ideal from an hygienic standpoint, but it was expensive to produce and its non-aeration made the taste flat. Boiling rendered the water safe as far as bacteria, true toxins and most forms of organic matter were concerned. Boiling, however, would not eliminate the effects due to stable inorganic chemical matter, such as lead salts. Boiling should be used when the source of the water was unknown or when it was known to be infected. The use of small filters was very limited. One of the most convenient methods of purifying water was by means of hypochlorite of calcium (bleaching powder). Dr. Sayers described the method in some detail. He said that he refrained from discussing the purification of large amounts of water, such as for whole communities, since such treatment should have the supervision of competent sanitarians. All drinking water for underground use should be properly disinfected by chlorination unless it was obtained from a source that had been approved by the State Department of Health. In order to avoid contamination during distribution the safest method was to run it in pipes from its source to convenient points for use underground. The use, however, of containers, barrels, tanks and so forth was probably most widely practised and was satisfactory for many mines. Containers required regular washing and sterilizing. Pipes should be laid above the floor and drainage water levels in order to avoid contamination by leakage of the pipes. In many mines the worker carried his drinking water in an individual pail. This was to be commended in that usually only one man drank from the pail and the possibility of infection was lessened. In using this method the source of the water should be controlled and drinking fountains or faucets should be placed on the surface or on each level underground. Contamination by the users of water could best be avoided by the abolition of common drinking cups and the substitution either of individual cups or of drinking fountains. The jet of water from a drinking fountain should be so directed and the fountain should be so constructed that it was impossible for the mouth of the individual to come into contact with the tap.

In discussing the question of sewage disposal Dr. Sayers pointed out that the question of intestinal parasites was important. The diseases resulting from improper sewage disposal included typhoid fever, cholera, dysentery, hookworm and other parasitic diseases. The way to prevent disease transmitted by sewage was to adopt measures which would prevent contamination of food and water by intestinal body waste. Water-carriage systems were impracticable underground. The best method was to use water-tight and animal-tight containers. Disinfectants should be used with all containers. Caustic soda, "Cresol" and "Tricresol" and similar disinfectants had proved satisfactory. If lime were used, it should be used extensively. It did not, however, kill hookworm eggs. Latrines should be placed in convenient situations, should be well lighted and the surroundings should be kept in a sanitary condition. Latrine cars had been used with success in many mines. Latrines could only be kept in a sanitary condition when the individual miners were of cleanly habits.

In discussing the question of ventilation in mines Dr. Sayers described the composition of normal air and said that it might be varied by depletion of oxygen, increase of carbon dioxide and the presence of abnormal gases, such as methane, hydrogen sulphide and carbon monoxide, together with the presence of various dusts. Of the non-poisonous dusts silica was the most harmful. Coal dust was dangerous chiefly because it was liable to explode under certain conditions. Ventilation would not prevent such explosions. The poisonous dusts were those obtained from lead, mercury, zinc and arsenic ores. In regard to the deficiency of oxygen, man had adapted himself to an atmosphere containing 21 volume % of hydrogen. In an atmosphere containing 17% of oxygen he would breathe a little faster and a little more deeply. Some men exposed to an atmosphere containing 15% oxygen became dizzy, complained of rapid heart action or suffered from headache. Very few escaped these symptoms when the percentage fell as low as ten. Haldane had stated that under certain conditions consciousness might be retained in a percentage as low as three and a half. Under other conditions consciousness might be lost at 9% or above that level. No one should attempt to enter an atmosphere containing less than 13 volume % of oxygen unless protected by a self-contained oxygen breathing apparatus. Carbon dioxide was a normal constituent of air in a percentage of 0.03. Leonard Hill had stated that the effect of breathing 0.5% of carbon dioxide was a slight and unnoticeable increase in the ventilation of the lungs. A presence of 2% carbon dioxide increased the ventilation of the lungs by about 50%, 5% increased it about 300% and 10% could be endured for more than a minute or two. The effects were headache, dimness of vision, sweating and tremor.

Hydrogen sulphide and sulphur dioxide were usually the products of decomposition of sulphide minerals, but might be produced from the burning of powder or explosives. As little as 0.05% to 0.07% of hydrogen sulphide would sometimes cause death after long exposure and 0.2% would cause death in a few minutes. When mixed with seven times its volume of air, sulphide of hydrogen was violently explosive. Carbon monoxide was the product of incomplete combustion of organic material. The United States Bureau of Mines had found that a canary collapsed in an atmosphere containing between 0.2% and 0.3% of

carbon monoxide. The bird had recovered when placed in a better atmosphere. The carbon monoxide detector which had been elaborated during the war, had been found to be a valuable supplement in the detection of the gas. It should be remembered that the presence of high temperatures and humidity accentuated the symptoms produced by these gases. High temperature and humidity decreased the efficiency of the miner and probably had a deleterious effect on his health. Sayers and Harrington had found that if the air temperature was above 23.8° C. (75° F.) and the relative humidity was high, the efficiency of the worker was increased by air movement. With a linear movement of thirty metres (one hundred feet) per minute a miner was comfortable and moderately efficient as long as the temperature did not rise above 29.4° C. (85° F.) as taken with the wet bulb thermometer. The same was true when the temperature was between 29.4° and 32.2° C. (85° and 90° F.) provided the air velocity was sixty to ninety metres (two hundred to three hundred feet) per minute. It had been shown repeatedly that good ventilation improved the efficiency of the miner. The installation of expensive equipment was paid for in very short time as a result of increased efficiency. The final solution of the problem was the permanent installation of a ventilating system which would replace hot humid air with cooler air and prevent the accumulation of harmful gases. Dr. Sayers concluded by saying that the operation of ventilation equipment depended largely on the miners themselves. It was a common experience that miners were not only reluctant to use equipment, but often wantonly destroyed it.

MR. P. H. WARREN in discussing the paper referred to the history of a man who had suffered from symptoms of gas poisoning while working in an atmosphere containing 16% of oxygen and 4% of carbon dioxide. The man had been exposed to the gas for five minutes. He had suddenly become dizzy and had been unable to walk for ten minutes. He had suffered from a headache for nine hours. Mr. Warren asked Dr. Sayers for his opinion of the condition.

DR. SAYERS in reply said that it was probable that the symptoms had been caused by the presence of a small percentage of carbon monoxide.

MR. H. M. MARRIOTT (Great Britain) said that he had recently had the advantage of discussing with Haldane the question of carbon monoxide poisoning. Haldane had told him of a revolutionary procedure, namely that in the treatment of men suffering from carbon monoxide poisoning he had discarded the use of oxygen inhalation and was using large doses of carbon dioxide. The action of the carbon dioxide was to induce intense activity in the medullary centres and acceleration of the heart's action. Oxygen was taken into the blood more quickly. In regard to ventilation of mines it was his opinion that the same intensity of forced ventilation should be used in metal mines as was required by law in coal mines.

DR. SAYERS said in reply that he had experimented with both oxygen and carbon dioxide on animals poisoned with carbon monoxide. Dogs treated by these methods had taken the same time to recover and the condition of the dogs after treatment had been the same. Henderson had said that carbon dioxide was superior to oxygen in the treatment of carbon monoxide poisoning. Dr. Sayers held that the question required further investigation. If too high a percentage of carbon dioxide were given, it might be dangerous, for a concentration of 10% would put a strain on the heart.

PROFESSOR H. G. CHAPMAN said he would like to focus the discussion on the physical standards. He wished to hear the opinions of those present as to whether it was sufficient from the physical standpoint to measure the temperature, the humidity and the rate of movement. If these were accurately measured, had all the factors been determined? The question of the composition of air could be abandoned except in as far as deleterious gases were concerned. The important point was the question of the rate of movement of the air. Investigations had been made at Broken Hill with the katathermometer. The resulting readings had not always been good with a low temperature and humidity of 100%. The men had shivered when they stood still, but at the same time they had liked working in these places. The katathermometer had broken down under these conditions.

DR. W. J. YOUNG had also found the katathermometer unsuitable under certain conditions. On a hot muggy day the readings often underwent wide variations. He thought that this was due to the smallness of the bulb of the thermometer. If it were possible to construct a katathermometer on a very much larger scale, the results might be more uniform. A large number of readings, if taken consecutively and expressed as an average, would probably give a satisfactory result. This was not always possible.

Native Labour in Papua.

MR. E. W. PEARSON CHINNERY read a paper entitled "A Few Notes on the Care, Management and Health of Native Labour in Papua." Mr. Chinnery began by giving a short account of the people of New Guinea and the general conditions of labour. He pointed out that all labour in Papua was voluntary. Definite regulations were laid down for the housing of the men and the rules in regard to superficial sleeping space and cubic air space were rigidly observed. Water was obtained from suitably protected wells or from running streams. Latrines consisted in pits protected by weather-board superstructures. On the slightest suspicion of bad sanitation the pits were filled in and new pits were dug. The food problem was supervised and an attempt was made by means of cultivated native foods to secure a variety, so that each day's food should contain the necessary food essentials. Mr. Chinnery said that in 1921 a serious epidemic of influenza had carried off a large number of natives and left its mark on the survivors. As a result it was necessary to keep watch constantly on every factor bearing on their health. He thought that in a large organization it would be useful to take the weight of native labourers periodically both for statistical purposes and for an indication of abnormal increase or decrease. It might be objected that this would tend to increase malingering, but in his opinion this was not so, for in both beri-beri and tropical sores the condition was often obvious to an observer before the patient became aware that he was ill. Mr. Chinnery held that when prevention was made the continuous object of the organization together with early detection, illnesses, when they did occur, were likely to be less severe. The law compelled each employer to have adequate provision in regard to both accommodation and drugs for those natives in his employ who became ill. The Papuan was a good patient when he understood the cause of his illness, but when a vague illness attacked him, he generally put it down to sorcery. Mr. Chinnery illustrated the incidence of illness by quoting the percentages as occurring on one place of employment. Serious illnesses, such as fever and influenza, had numbered 43.49%, minor illnesses 2.77%, venereal diseases 0.59%, rheumatism 1.77%, sore mouth 4.34%, sore eyes and ears 2.17%, decayed teeth 0.19%, boils 5.33%, skin lesions 0.4%, sore legs 22%, sore arms 2.23%, cuts and minor injuries 9.88% and miscellaneous lesions 4.74%. Mr. Chinnery described the peculiar characteristics of the native and the difficulties met with by the employer in looking after his general welfare. It was his opinion that the reputation of the employer had much to do with the successful industrial development of the country. He spoke as one connected with an organization employing seven hundred natives.

DR. J. S. ARMSTRONG (Samoa) referred to the labour conditions in Samoa. The general health of "boys" employed on the plantations was good. Beri-beri had occurred among the Chinese and had been due mainly to the use of a large consignment of rice that had been bought cheaply two years previously. The increase in beri-beri in this instance had been enormous. With the consumption of fresh vegetables the number of those affected had been reduced. The growing of fresh vegetables was a serious problem. According to the terms of their contract the Chinese labourers had previously not been allowed to accept employment for any one else than their masters. They had not been allowed to grow vegetables for sale,

even if they wished to do so. The plantation owners only allowed one or two men to keep a farm for the use of the plantation. There was no profit for the gardeners and no incentive. An effort was being made to allow labourers to grow vegetables and it was hoped that a constant supply would be provided.

DR. W. WATKINS-PITCHFORD (South Africa) said that the periodic weighing of natives was a most important measure. It was not only useful as a general index, but gave an opportunity for periodical inspection. According to the regulations in force in South Africa native miners were supposed to be medically examined every three months. The natives numbered 200,000 and the task had been gigantic. He had suggested that weighing, if recorded, would take the place of the examination. "Boys" who were shown to have lost more than about two and a half kilograms, could be submitted to a more searching examination. The plan had worked satisfactorily. The "boys" might be weighed when they were paid or at some similar time. There was a definite utility in the recording of the weight by means of individual cards carrying serial numbers. These records supplied the nucleus for hospital records. If no other records were in existence, it was possible to go a long way in controlling the system.

PROFESSOR C. J. MARTIN, F.R.S., referred to the condition of sore mouths. They were probably of the nature of a spirochætal gingivitis. It was a very infectious condition and could easily be spread by means of spoons and cups. It was amenable to the use of arsenic in weak solutions. He also referred to the origin of beri-beri as having been ascribed to a defect in rice. It had been sometimes found that the better the quality of the rice, the worse had been the beri-beri. It was more completely decorticated. It was probable that some other factor was operative in addition to that of the deficiency of the accessory food factor.

Distribution of Air in Metal Mine Ventilation.

A PAPER written by MR. DANIEL HARRINGTON of the Bureau of Mines, Washington, and entitled "Distribution of Air in Metal Mine Ventilation with Especial Reference to Flexible Tubing" was read by DR. A. J. LANZA. Mr. Harrington began by pointing out that the "blind ends" in mines seldom had sufficient circulating air to be measured by an anemometer or even to be discerned by the deflection of a candle flame. It had been found in mining districts in the United States that workers in "blind ends" continually breather air containing 0.02% to 0.04% of carbon monoxide. In some mines carbon dioxide had been present in such concentration that a candle would not burn, though an acetylene lamp would do so. The oxygen content of the air had been below 17% but above 12%. In other mines gases, such as sulphuretted hydrogen and sulphur dioxide, had been found. The high temperatures and relative humidity had been such that health was injured and it had been impossible to produce an adequate amount of work. Circulating currents of pure air constituted the best available remedy to prevent ill-effects. It had been found in South Africa that merely by giving movement to air at 30.5° C. (87° F.) and with a humidity of nearly 100% a native worker had increased his output of work by over 45% and had not known that he was doing so. In many mines the supply of fresh air at the face was dependent on compressed air from the drills. Even if this were continually used as in drilling a hard surface, the supply of air was quite inadequate. A large mine was generally supplied with air compressors with a capacity of less than 150 cubic metres (5,000 cubic feet) of air per minute and this was grossly insufficient to ventilate even a small mine. Distribution of air by coal mine methods of bratticing would be applicable in moderate-sized levels, stopes and other passages, but would be impracticable in workings with very large areas, for such openings frequently had barely sufficient clearance for cages or even men. Rigid metal tubes had been used in delivering air to the faces in many metal mines. Such tubes had the advantage of long life, though they were expensive to set up and often difficult to instal, maintain and remove in some situations. Flexible tubes as used in the United States had the advantage of lower original cost. They were lighter and less bulky and could be more easily transported from place to place. They leaked less than rigid tubes. They were also more adaptable to the more or less abrupt changes in the direction of the workings. Mr. Harrington pointed out that the disadvantages of flexible tubes were the facts that they were unable to resist mechanical abrasion and deterioration as well as rigid tubes. They offered more frictional resistance to the passage of air and thus required more power than rigid tubes. He was of the opinion that the risk from fire in regard to flexible tubing was mainly theoretical. The flexible tubes were of varying sizes and composed of canvas. They had a diameter of from twenty to sixty centimetres. The surface of the canvas was treated with various solutions to prevent decay. The condition most productive of decay was the passage of hot, humid air through the tube. Mr. Harrington quoted figures to demonstrate the standards that had been worked out in regard to the horse power of electric motors required for the tubing of different diameters. He further illustrated the benefits derived from the installation of a flexible tube system by reference to the facts concerning one mine. At the face of one tunnel 750 metres (2,500 feet) long the air had had a temperature of 29.4° C. (85° F.) and a relative humidity of 100%. It had been necessary to renew the working crews at least three or four times in each month. Two small fans and some forty-centimetre tubing had been installed and air had been circulated from a raise. The temperature of this air had been 26.1° C. (79° F.) and the humidity 100%. On the liberation of about one hundred and twenty cubic metres (four thousand cubic feet) of this hot air per minute the men had worked readily and willingly and their progress per day had been almost doubled, while the cost of excavation had been reduced by over 40%. Mr. Harrington concluded his paper by referring to the fact that an insurance company had recently reduced its premia for miners in good health by from 25% to 40%. This had been done on account of the good results obtained from the use of wet drills and good ventilation.

Mine Sanitation at Broken Hill.

IN the absence of MR. J. W. SALTER, DR. J. H. L. CUMPSTON read a paper written by Mr. Salter entitled "Mine Sanitation at Broken Hill." Mr. Salter began his paper by referring to the early attempts that had been made to deal with the question of mine hygiene at Broken Hill. The likelihood of the occurrence of lead poisoning from mining lead carbonate had been the cause of such action. A regulation had been framed by the Mines Department in 1906 making it compulsory to use water when boring holes in the underground workings. Mr. Salter discussed the question under several headings. In regard to underground ventilation he described the methods adopted in the several mines of the district. In those mines in which ventilation was produced by mechanical means, the fans had been installed at the surface in the upcast shaft in every instance but one. The *Mines Inspection Act* of New South Wales required that an adequate amount of ventilation should be constantly produced in each mine. Mr. Salter said that it was essential that no portion of the air should short circuit and escape to the upcast shaft before it had traversed some of the workings. The standard recommended by the Technical Commission of 1920 had been a velocity of six metres (twenty feet) per minute or alternately a volume of one hundred and fifty cubic metres (five thousand cubic feet) per minute according to the size of stope. According to the *Eight Hour Act* of 1916 the working hours of employees should not exceed six hours daily when the wet bulb temperature of the place exceeded 27.2° C. (81° F.). The result of this was that when the temperature approached this level steps were immediately taken by the companies to introduce more ventilation and reduce the temperature. In no mine on the field was a six-hour shift being worked. In regard to the improvement in working conditions, Mr. Salter pointed out that under the Edmunds Award the underground employee worked a shift of seven hours on five days a week. There was always an hour's interval

between shifts. A recent regulation made it compulsory to do all firing at the end of a shift unless a permit had been obtained to do it at some other time. In this way the ventilation currents cleared the smoke and dust out of the workings before the men returned. Men engaged in shovelling broken ore were compelled by regulation of the Mines Department to wet the heap and see that it was kept wet. Mr. Salter described in some detail the different types of drill with which experiments were made, and stated that the "rolled hollow steel drill' had satisfied the men. This type of drill was used at the present time and was preferred for all classes of mining. Another factor in improved conditions was the reduction during recent years of the temperatures of the mines. There were several reasons for this. The first was the improvement in ventilation. The second was the fact that depleted stopes were filled with moist residues from the mills. A third was the cooling which had occurred from the failure to open up new levels in recent years thus avoiding the exposure of new rock surfaces with consequent increase of temperature. Mr. Salter made long reference to the katathermometer reading and claimed that they were of considerable use to the mining engineer in regard to ascertaining the degree of comfort in each part of the mine. He pointed out also that the water supply of the mines was taken direct from the water service of the town. The water was taken down in pipes and drinking water was stored in closed metal tanks on the platforms or elsewhere on the levels. In the mines at Broken Hill there were no working places which necessitated the men working without a woollen singlet. In regard to the sanitary systems, pan latrines were used as well as water closets connected with septic tanks on the surface. In the underground workings the pan system was in vogue. The newer latrines had concreted floors, all the walls were whitewashed. An attempt to use a septic tank underground had not been a success. A sanitary man was employed whose work was confined to the keeping clean of latrines and of places where the men ate their meals. Efficient change houses were provided at all the mines in Broken Hill. An attendant was constantly employed. It was his duty to hose the concrete floors and keep the basins clean. Mr. Salter referred to the findings of the Technical Commission in 1920 and said that a medical board had been appointed for the determination of whether a given employee was suffering from lead poisoning or not. An employee desirous of changing from the service of one company to that of another had to be passed by the medical board before he was allowed to do so. A man desirous of entering the industry had also to submit to medical examination.

Hygiene in Coal Mines.

PROFESSOR H. G. CHAPMAN read a summary of an interesting paper written by MR. A. A. ATKINSON entitled "Ventilation, Hygiene and Accidents in Coal Mines." In dealing with the question of ventilation Mr. Atkinson began by giving the composition of normal air and its components in their relative proportions by volume. He then discussed *seriatim* the noxious gases met with in coal mines. He stated that carburetted hydrogen or methane was the most dangerous gas. The lower explosive limit was about 5% methane and upper limit 15%; the most explosive mixture was one in which about 9.5 volume % of methane was present in air. It was usually given off from coal in a regular manner, but sometimes was given off suddenly and in large volumes from faults, falls of the roof or cavities in the seam. As a result of the incomplete explosion of methane (fire-damp) and air the deadly after-damp was formed. This was a mixture of carbon dioxide, carbon monoxide, nitrogen, vapour of water and occasionally sulphuretted hydrogen. Carbon monoxide was the gas responsible for the fatalities. Mr. Atkinson referred to the composition of a gas known as "bottom gas" and found occasionally in the mines in the Illawarra district in New South Wales. This gas had been described by J. R. M. Robertson as possessing peculiar properties. It lay on the floor and emanated from the rise workings. It flowed like a liquid to the lower workings and filled them from the floor upwards. Its composition was: Carbon dioxide 50.22% marsh gas 31.28%, carbon monoxide 10.85%, hydrogen 0.92% and nitrogen 7.50%. According to J. R. M. Robertson this gas was swept out by the enormous ventilating current. J. S. Haldane had examined samples of the gas. He had found no carbon monoxide in its composition, but had said that the samples were unique. Sulphuretted hydrogen was generally found in old workings and resulted from the decomposition of iron pyrites or the decay of vegetable matter. It was about five times as dangerous as carbon monoxide and much more rapid in causing death or dangerous symptoms. Mr. Atkinson made some interesting comparisons between the ventilation requirements in Great Britain and in New South Wales. In the New South Wales act the air for ventilation must be drawn "from a pure source." In the Imperial act a certain standard was necessary. The air must not contain less than 19% of oxygen nor more than 1.25% of carbon dioxide and in an intake airway there must not be more than 0.25% of an inflammable gas. In the New South Wales act a definite quantity of ventilation was required for each person or animal below the ground. In the Imperial act it was stated that "an adequate quantity" should be produced. According to the New South Wales act ventilation must be continually produced. This had been brought into force as the result of an explosion in 1910. The Imperial act held the same provisions. In the Imperial act there was an advantageous clause in regard to the monthly measurement of air in certain defined places. In the New South Wales act no places were specified. Unlike the New South Wales act the Imperial act provided that the main fans for ventilation should not be placed below the surface. In the Imperial act the provisions in regard to safety lamps were much more definite than in the New South Wales act. In regard to the question of adequate ventilation the conditions existing in different mines were the determining factor. In order to provide adequate ventilation in all parts of a large colliery all shafts, tunnels and airways should be made of large sectional areas so as to reduce the velocity and friction of the air. The distribution in order to obtain the best results should be effected by judicious splitting of the air currents and unnecessary leakages should be prevented by putting in good stoppings, air crossings and double doors where necessary.

In his opening remarks in the section of his paper on hygiene, Mr. Atkinson expressed the opinion that the best results in regard to the health of mine workers would be obtained by the cooperation of the mining engineers and the members of the medical profession. In comparing the health of coal miners with that of other workers, Mr. Atkinson pointed out that, although mining was considered a dangerous occupation, the miners' death rate from all causes including accidents was below the average of that of all occupied males. In discussing the diseases to which coal miners were liable, Mr. Atkinson stated that although coal miners were subject to diseases of the respiratory system and to bronchitis after the age of sixty years, a diminution in the incidence of bronchitis had occurred. This had been held by Haldane to be due to improvement in ventilation. Mr. Atkinson made considerable reference to the subject of miners' nystagmus and to the report of the Miners' Nystagmus Committee. This report was dealt with in the pages of this journal in the issue of September 9, 1922. Mr. Atkinson referred to the writings of some observers who differed from the findings of the committee in regard to the deficiency of light as the cause of nystagmus. The noxious gases had been held by some to be in a measure responsible for the causation of the condition. Mr. Atkinson pointed out that these conclusions were not accepted amongst those best able to judge, but stated that it must be admitted that the question of miners' nystagmus had not been definitely settled. In discussing the general effects of defective ventilation, temperature, moisture, dust and so forth on the health of underground workers, Mr. Atkinson said that the miners preferred a dry atmosphere and made a comparison with the muggy atmosphere of coastal air and the dry air of higher country places. He gave in detail instances in

which the installation of ventilation plants had been effective in improving working conditions. In regard to anchylostomiasis Mr. Atkinson reviewed the history of its association with mining conditions. He also referred to the statement of Dr. Sweet that no hookworm had been found in the Victorian, South Australian, Western Australian or Tasmanian mining fields and that for practical purposes the miners of New South Wales could be regarded as free from the disease. Mr. Atkinson then referred at some length to the subject of pit-head baths. He recognized their value and the difficulty in making some of the older men appreciate them. He had come to the conclusion on this account that it would not be wise to insist on their use. In regard to the accidents occurring in mines Mr. Atkinson went into the subject very fully and gave statistics of the various types of accident occurring in coal mines.

Ventilation and Dust Control in Metal Mines.

MR. P. H. WARREN (Broken Hill) read a paper entitled "Ventilation and Dust Control in Metal Mines." In his opening remarks Mr. Warren said that it had been abundantly proved that the most efficient and competent workmen were those who were physically strong and whose health was not impaired as a result of their employment. He then traced the gradual development of interest in the question of mine ventilation and dealt briefly with the various commissions and investigations of a similar character which had been used in an endeavour to elucidate the problem. In regard to the ventilation of metal mines the quality of the mine air was of importance. Normal air consisted of oxygen 20.61%, nitrogen 77.95%, carbon dioxide 0.04%, moisture 1.4%. Samples of air taken in a mine at Broken Hill had been composed of oxygen 20.28%, nitrogen 78.48%, carbon dioxide 0.229% and carbon monoxide 0.0047%. Endeavours had been made to base a standard purity of mine air on the contents of carbon dioxide. The standard had been fixed at 0.2% to 1.25%. Recent investigations had shown that air might contain up to 2% of carbon dioxide without the production of any harmful effects. The quality of mine air differed from surface air in regard to temperature and humidity. In Broken Hill the mean annual temperature was 13° C. (56° F.) wet bulb and 18° C. (65° F.) dry bulb. The relative humidity was 51% and the moisture content eight grammes per cubic metre (3.5 grains per cubic foot). The average temperatures in the working places of one of the large mines had been found in a recent survey to be 22.3° C. (72.2° F.) wet bulb and 23.2° C. (73.8° F.) dry bulb. The relative humidity had been 96.96% and it had contained 18.8 grammes per cubic metre (8.25 grains per cubic foot). Every 2.3 grammes of moisture added by evaporation to one cubic metre of air corresponded to the cooling effect of 4.5° C. (8° F.). In an observation taken at a depth of 381 metres the temperature should have dropped 17.7° C. because the air had taken up 0.24 gramme additional moisture. The heating effect due to compression was 3° C. for each three hundred metres of depth and a certain amount of heat was taken up from the rock surfaces. The net result in this particular reading had been that though the temperature had dropped from a dry bulb reading of 30.5° C. (87° F.) on the surface to 21.9° C. (71.5° F.) at the 381-metre level, the capacity for holding moisture with a further increase in temperature had been much reduced. The air temperature could not rise higher without affecting the health of the men unless the loss in potential cooling effect or evaporative capacity were made good by imparting to the air a considerable velocity. Air movement was of considerable importance as a factor affecting the cooling power. In this regard Mr. Warren quoted at some length from the report of a committee appointed by the Department of Scientific and Industrial Research in England in 1919. In this report it had been pointed out that no animal could withstand such extremes of temperature as man. In man the temperature was regulated voluntarily by clothing and exercise and involuntarily by several means. The involuntary means included the regulation of the flow of blood through the skin and the tendency to the increased production of heat within the body by increased muscular activity in a cold environment. The method of regulation was of more importance in regard to mines. This was concerned with the sweat. When water evaporated the amount of heat required for its conversion into vapour was enormous. A miner working at his full capacity might produce an average of 250 calories per hour for seven hours as compared with seventy during rest. Hence if the air and body temperatures were constant, so that he could not lose heat by radiation or convection, he would require to evaporate during the shift about three litres of sweat per hour, for one kilogram of water at body temperature required 582 calories for conversion in aqueous vapour at the same temperature. With a lower air temperature the evaporation could be less as most of the heat would be lost by conduction or radiation. The body could easily produce sweat at this rate provided sufficient water were drunk. In saturated air evaporation from the skin could only occur if the air were saturated to a temperature lower than the body temperature. The rate of evaporation was practically proportional to the rate at which the air passed over the skin or clothes. Unsaturated air tended to cool down a moist surface to the dew point and also by conduction to warm up a cooled surface to the air temperature. The practical effect of air in circulation was that when there was sufficient to swamp the influence of radiation and conduction through still air, the surfaces assumed a definite temperature between the air temperature and the dew point. This was the wet bulb temperature. The temperature of the skin was intermediate between the wet bulb temperature and the body temperature, as the latter was tending to warm the skin. The greater the air current the more nearly would the skin temperature approximate the wet bulb temperature. The wet bulb temperature must, therefore, always be kept below the body temperature. When it approached the body temperature, there should always be a considerable current of air in circulation, but this was of no advantage if the wet bulb temperature was above the body temperature. In practical mining the aim of the mining engineer should be to keep down the wet bulb temperature and a subsidiary aim should be to keep the air in motion in all working places. Mr. Warren also said that Leonard Hill's katathermometer was an instrument which was of the utmost service in mines. He described the instrument and the method of its use.

The objects of the ventilating engineer were to obtain an adequate supply of air in circulation and an equable distribution of air in the working places of the mine. Natural ventilation was capricious and unreliable and mechanical ventilation was a necessity in order to provide control both in regard to quantity and direction of flow. He described in detail the proper arrangement of a ventilating scheme and illustrated it by diagrams and lantern views. He regarded the ventilation of developmental deadends as a separate and most important problem. The hygienic conditions in these places were the worst encountered in mining chiefly on account of dust concentration after firing. Small blower units were the most suitable appliances in this connexion. The air in these circumstances was delivered through galvanized iron or canvas tubes to the face of the opening. It was difficult to lay down standards in regard to ventilation. Experience at Broken Hill and elsewhere had shown that wet bulb temperatures varying between 26.6° C. and 29.4° C. (80° F. and 85° F.) in working places were capable of reduction to about 23.8° C. (75° F.) when the ventilation was controlled. The katathermometer was the best means available for measuring the conditions. When the wet bulb temperature rose above 23.8° C. (75° F.) and the katathermometer readings fell below 4 dry and 11 wet, some effort ought to be made to effect an improvement.

In regard to the production and control of dust in mines, Mr. Warren referred briefly to the different varieties of dust in mines and pointed that the individual particles collected in mines were very small. The greatest number were between one and two microns in size, while 98% were under five microns. The recognition of the fact that the dust in miners' lungs was found to consist of very small particles had led to the development of the konimeter, an instrument in which the number of particles in unit

volumes could be counted and also examined in regard to size and other physical characteristics. The konimeter had many points in its favour, but the personal factor bulked largely in its use and it did not differentiate between soluble and insoluble particles. There were other methods of examining samples of air. One method was the gravimetric method. It was necessary in regard to this method to have equipment which would measure accurately the volume of air sampled and filter sufficiently the measured volume of air. The media for this purpose were sugar or distilled water. Mr. Warren referred to the electro-static equipment described by Pentiado Bill and said that it was too complex to be suitable for use in mines. The Kotze air ejector had first been suggested by Sir E. Kotze in South Africa. In view of the fact that compressed air was available in Broken Hill, the Kotze pump had been incorporated into a suitable unit together with a pilot tube, manometer, a scale calibrated to show litres per minute and a detachable bracket to carry either a sugar tube or a water spray sampler. Filtering media used were either sugar or distilled water. In Broken Hill a water spray sampler was used for the purpose. It had been designed by Mr. T. A. Read, of Broken Hill, and had proved highly efficient. The United States Bureau of Mines had developed a simple dust sampler called an "impinger." The air to be supplied was bubbled through distilled water. It had been found satisfactory in Broken Hill, but as it was made of glass, it would be necessary to develope it into a more durable form for underground work. In regard to standards it was difficult to lay them down on account of the difference in dust and the varying degree of susceptibility of the human body to dust. It was more practicable to adopt as standards those degrees of dustiness which could be shown by test to obtain under the best conditions of ventilation with the most efficient means of dust suppression. Tentative standards were 300 to 500 particles per cubic centimetre of air for konimeter samples and five milligrammes per cubic metre of air for gravimetric samples.

The main causes of dust production in mines were boring, shovelling and filling and blasting. Mr. Warren illustrated the different types of boring machines and explained the manner in which water was used with each. He quoted figures in order to prove that the use of water with drills reduced the production of dust. In filling and shovelling the men inspired more air than those engaged in turning on a machine. It was necessary to use sprays of water while thus engaged. The operation of blasting produced the greatest amount of dust. In order to control this dust several expedients were adopted. Promiscuous firing had been eliminated in Broken Hill. All except 5% of the total quantity of explosive was fired at the end of the shift. An interval was allowed before returning to the working places after blasting. The interval should be at least thirty minutes. Ventilation was important and water blasts should be installed to lay the dust. MR. Warren described experiments by which the value of these procedures had been demonstrated. In conclusion he laid stress on the importance of keeping records of the results of tests in working places.

Dust Affections in Mines.

PROFESSOR H. G. CHAPMAN communicated a paper entitled "Dust Affections in Mines." After giving a review of the conditions under which mining was carried on in Broken Hill, he pointed out that dust derived from blasting was removed by the air current ventilating the mine except in certain dead ends where a water blast was used. The provision of a sufficient air current was the duty of those laying out the mines. A minimum rate of flow of air at the rate of six metres (twenty feet) a minute or of one hundred and fifty cubic metres (five thousand cubic feet) per minute past any section was found necessary under the conditions obtaining at Broken Hill. The dust arising from drilling, removing ore and other operations was controlled by the miner. Education of the miner in respect to the danger of dust and training in the proper methods of preventing formation of dust was very necessary. It seemed as if drilling had been the most dangerous operation at Broken Hill in giving rise to pneumonoconiosis. He then described the forms of the disease found at Broken Hill. Stress was laid on the absence of dyspnœa in most persons affected with the first and second stages of pneumonoconiosis. Signs and symptoms did not become prominent until tuberculous infection had occurred. Pathological studies showed that the absence of dust around the air spaces of the lungs and the accumulation of dust around the medium sized and small bronchi accounted for the small amount of dyspnœa. Figures were given to show the amount of uncomplicated pneumonoconiosis and of pneumonoconiosis complicated with tuberculosis among the workers of Broken Hill mines. These forms of disease were restricted to those who had worked underground with drills. Other workers underground were free from pneumonoconiosis. The percentage affected rose from about 1% among those who had worked ten years and under, to 15% among those who had worked thirty years and over as miners underground. No person who had worked less than eight years, had contracted the disease. A sufficient number of persons who had only worked in mines at Broken Hill, were found affected with pneumonoconiosis to show that pneumonoconiosis could be caused by working in these mines. Further evidence on this problem was obtained by analyses of the lungs obtained at autopsies on miners. The association of lead, zinc, manganese and silica in the ash of the lungs made it certain that dust from a Broken Hill mine had accumulated within the lungs. The amount of dust found had been from one hundred milligrammes to five hundred milligrammes in each hundred grammes of dried lung constituents.

In regard to hygienic measures Professor Chapman stated that miners affected by dust were removed from the mines and advised to work in the country where they would come into contact with fewer persons than in more crowded areas. Statistics obtained showed that only one person out of forty who went into country districts, contracted tuberculosis, while thirteen out of sixty remaining in Broken Hill contracted tuberculosis. All those suffering from tuberculosis had shown advancement of the disease in the three years that had elapsed since their initial examination. In conclusion Professor Chapman gave figures to show the necessity of examining the whole of the members of a group to determine accurately the ratio of mortality among them.

Miners' Phthisis.

DR. W. WATKINS-PITCHFORD (South Africa) read a paper entitled "Miners' Phthisis: Its Cause, Nature, Incidence and Prevention." In the opening part of his paper Dr. Watkins-Pitchford discussed the name of the disease. He said that from the earliest days the occurrence of a wasting disease had been recognized as associated with certain trades. In the middle ages this had been known as the "rot." The name implied decay. Flint knappers' rot, potters' rot and grinders' rot had been recognized. The term phthisis had the same meaning. Used by itself the word phthisis designated pulmonary tuberculosis. The Parliament of the Union of South Africa had substituted the term silicosis for that of miners' phthisis. There were two principal forms of the disease. These were simple silicosis and tuberculosis with silicosis. The latter group might again be divided into tuberculo-silicosis and silico-tuberculosis. The cause of silicosis was the presence in the lungs of abnormal quantities of natural silica in the form of minute fragments which were optically birefringent. The dust of minerals and other substances containing silica in the form of silicates was relatively if not entirely harmless to the lungs. This fact should not be abused, for it was not natural or healthy to breathe quantities of any sort of dust. Silicosis was an occupational disease, but among some twenty thousand candidates for underground work who had not been engaged in mining or any occupation usually associated with silicosis, the Miners' Phthisis Medical Bureau in South Africa had discovered only four or five instances of the disease. There was a general lack of knowledge in England and Wales of silicosis as an occupational disease and of the

part played by the inhalation of particles of silica in producing an excessive mortality from what was supposed to be ordinary phthisis. In a report recently published by the Registrar-General on the mortality from various causes in some one hundred and thirty-two occupations, silicosis or miners' phthisis did not appear at all; the industries showing the highest relative mortality from phthisis were, in nearly all cases, those in which siliceous dust was inhaled.

In discussing the disease he proposed to deal with it as it affected the gold mining industry in South Africa. In the first place he referred to the arrangement of the connective tissue in the lungs and the phenomenon of phagocytosis. He illustrated the latter by a series of lantern slides and showed pictures of cells, known as dust cells, which had engulfed particles of silica and were found in the areolar tissues of the lungs. It had been an interesting problem to determine the origin of these dust cells. This question had been investigated by Dr. A. Mavrogordato who had thrown much light on it. It could be seen that not only the carbon particles but also the particles of silica looked black in the ingesting cells. Mr. Mavrogordato had found that this appearance of the silica particles was due to their having become coated by a special pigment formed by the cell soon after it had engulfed the particle. Dr. Watkins-Pitchford illustrated his remarks by slides many of which had been prepared from Dr. Marvogordato's specimens and said that the conclusion was inevitable that the dust cells which were found in the interstitial tissue of the lung, had been originally some of the endothelial cells lining the air vesicles. When these cells had engulfed particles of inhaled foreign matter, they detached themselves from their positions and were either shed into the cavity of the vesicles and escaped in the expectoration or made their way backwards into the areolar tissue which lay behind the air vesicles.

The essential change in the lung in simple silicosis was the formation in the areolar tissue uniformly throughout the lung of scattered deposits of new fibrous tissue. In this way the lung lost much of its elasticity and there was produced one of the earliest and most characteristic symptoms, namely a diminished power of chest expansion. Thus interference occurred with the function of aerating the blood. Interference was also caused by the same deposits of new fibrous tissue encroaching upon and obliterating the air vesicles and smaller tubes in their immediate vicinity. This impairment of function was often recognized by the individual as shortness of breath of a novel character. It was also quite common for the deficiency in oxygenation to result in the development of some degree of obesity. Investigation had shown that each of the minute bundles of fibrils of the new tissue originated from the transformed body of a dust cell or other fibroplastic cell and that many of these cells had previously engulfed one or more particles of silica. No other mineral was known at the present time which was capable of producing these changes with such certainty. It would be readily understood that in the earliest stages of the disease collections would be found not of fibres but of these silica-bearing dust cells before they had changed into fibres. The cells could be seen to contain something else besides pigment. If the light passing through the microscope were polarized, the section would assume the appearance of the starlit sky on a moonless night. This appearance was due to the presence of birefringent particles of silica. By patient examination of many specimens all the stages of the change of these cells into fibrous tissue could be traced. The cells soon tended to become elongated and then assumed a wedge-shaped appearance and fibrils appeared in their substance. When next examined the bodies of most of these cells would be seen to have become completely converted into fibrils and finally no trace of the cells in their original form would be discoverable, but merely a compact collection of circularly arranged masses of fibrous tissue. Among the fibres would be found deposits of the pigments or silica which had originally formed the burdens of the defunct cells. If the dust-bearing cells passed backwards into the areolar tissue in large numbers during a short time, the partitions between the vesicles became widely distended with these cells. The walls of the air vesicles thus became greatly thickened and some of the cells that had had been shed into the vesicles, joined the thickened wall and converted the previously hollow vesicle into a compact mass of cells. In this way a continuous mass of tissue composed of dust cells was produced; the end result was a typical silicotic nodule. It was thus evident that the dust cells entering the areolar tissue were nothing more or less than the flattened endothelial cells which normally lined the pulmonary vesicles. The behaviour of the dust cell after the ingestion of siliceous material was due to the peculiar influence of the silica on the cell. The action of tubercle bacilli on the ingesting cell was very similar. The cells, however, after ingesting tubercle bacilli were very liable to undergo fatty degeneration and to die before they could complete their transformation into fibrils.

Dr. Watkins-Pitchford referred to the changes occurring around blood vessels and air tubes. He pointed out that after a heavy exposure to dust the meshes of the pulmonary areolar tissue became crowded with dust cells. These migrated in large numbers from the vesicles along the areolar tissue sheaths surrounding the vessels and air tubes. He showed slides illustrating the changes around venules and arterioles. The numerous dust cells became converted into fibrous tissue and the lumen became obliterated by a delicate fibro-cellular connective tissue. Even such a serious change tended to undergo a process of cure and the connective tissue in the lumen became channelled by new capillaries. The surrounding fibrous tissue became looser in structure and tended to become broken up into granules. The changes around the smaller air tubes were of similar nature. Dr. Watkins-Pitchford illustrated the progressive changes by a series of microphotographs.

In regard to the size of the particles of silica producing the disease, it was limited in an upward direction by the size of the cells capable of swallowing the particles. The dust cells varied in size from eight to fifteen microns. It was interesting to note that excessively small particles were incapable of producing silicosis. Dr. Mavrogordato had found that ainmals could be made to breathe large quantities of fine impalpable chemically precipitated silica without the production of silicosis. There were two possible explanations of this. Either the particles (which were below the limit of microscopical resolvability, *id est* below 0.2μ) did not enter the dust cells at all or. if they did enter, they were so small as to be speedily dissolved and excreted in solution.

In discussing the relationship between simple silicosis and silicosis with tuberculosis, Dr. Watkins-Pitchford said that the term simple was applied to silicosis when it was not obviously accompanied by infection with the tubercle bacillus. He expressed the opinion, nevertheless, that it was probable that the tubercle bacillus might also play an important part in developing the deposits of fibrous tissue in the majority of the lungs affected by what was known as simple silicosis, in spite of the fact that many of the patients might not show signs of being obviously tuberculous for the remainder of their lives. The simple form of silicosis was ten or twelve times more frequent in its incidence on miners than the form which he termed silicosis with tuberculosis. Simple silicosis was not in itself a dangerous disease. Unless complicated by tuberculosis it tended slowly towards a natural cure. The presence of simple silicosis, moreover, did not materially add to the risks of such diseases as lobar pneumonia or influenzal broncho-pneumonia. The special danger was the liability of the individual with simple silicosis to develope an obvious infection with the tubercle bacillus.

In discussing the question of tuberculosis with silicosis Dr. Watkins-Pitchford said that if precision were respected the term tuberculosis could not correctly be applied to the infective process in the majority of patients suffering from tuberculosis with silicosis, because tuberculosis was a disease characterized by the presence of tubercles. Tubercles were only occasionally found in a previously

silicotic lung when it had become infected with the tubercle bacillus. Tuberculo-silicosis was characterized by infiltration of the small fibrous deposits in the lungs by small round cells and by an exuberant production of new fibroplastic cells. As a result of this the pleura might be greatly thickened and the same might occur in the lobular and interlobular connective tissue. The latter change gave rise to the characteristic appearance known as "fibrotic figures" on the cut surface of the lung. The growth of fibrous tissue might strangle the vessels and air channels of affected lobules and thus lead to consolidation, necrosis and cavity formation. These changes could be detected in consecutive radiographic examinations. Silico-tuberculosis occurred when a man already affected by what was clinically a simple pulmonary tuberculosis, subsequently developed signs of silicosis. It was not of frequent occurrence for only eighteen cases had originated during the previous year amongst 13,640 miners. It was an embarrassing condition in the administration of the medical section of the *Miners' Phthisis Act*.

Practically the only source of tuberculous infection in the Transvaal was from persons suffering from pulmonary tuberculosis. Infection by the agency of dairy stock was negligible.

Dr. Watkins-Pitchford discussed the incidence of silicosis in the South African mines and quoted many statistics to show the great reduction that had taken place in recent years. He attributed much of the diminution to the recognition of the ante-primary stage of the disease and to the fact that men known to be tuberculous were prevented from working underground. He referred to the fact that a miner who developed simple pulmonary tuberculosis, received monetary compensation on being debarred from continuing his underground occupation. In no other industry or place in the world did this take place. He said that there were many arguments for the continuance of the practice, but that he would refer only to one. In more than half the instances in which they had been able to examine the lungs of miners who had died of apparently simple pulmonary tuberculosis after a mining experience of more than four and a half years, signs of silicosis had been found to be present. He held that in these circumstances it would be impossible to assert that the slight degree of silicosis had not predisposed to the fatal and during life apparently simple tuberculosis. He discussed the more important measures which were adopted to prevent dust formation in mines, and pointed out that from both the ethical and legal side it was the duty of the mine managements to protect the miners from dangerous dust while they were on mine premises. He did not think that the duty of preventing silicosis rested solely with the employers. It was the duty of miners both to themselves and to their dependants to make themselves fully acquainted with the various dust risks. A full appreciation of the facts by the miners would result in the total abolition of miners' phthisis.

Discussion on Mine Hygiene.

DR. A. J. LANZA in opening the discussion on mine hygiene said that the papers which had been read, embodied the results of years of work. One of the points which had been brought out, was the ubiquity of siliceous dust and its importance as a hazard outside mines. The hazards were realized and the mortality accompanying them. The possibilities of overcoming these hazards were also realized by the mining companies. There was another phase which reflected back to the government and that was the limitation of the men working underground. Miners were migratory and might leave one district and go to another. He had noticed that coal miners going to work in metalliferous mines succumbed to siliceous dust more rapidly. This migration often happened during coal mine strikes. Behind this lay the question of compensation and the migration of miners made the just distribution of the compensation payments difficult. Some mention had been made of the issuing of licences to miners in regard to the handling of explosives. This was carried out extensively at the present time. He suggested that the issuing of licences to miners might be undertaken in regard to their physical condition. He held that the physical supervision of miners was inevitable. It was obvious that all compensation was in the end reflected on the community as a whole.

MR. P. H. WARREN referred to Mr. Harrington's paper on flexible tubing. He agreed that the developmental ends were the bugbear of mine ventilation. Compressed air had been used in a most wasteful and extravagant manner. Its use had frequently been productive of bad dust conditions particularly after firing. It could be used effectively by means of a jet directed into a ventilation pipe as a kind of small pump. In Broken Hill small ventilating units were used with an electric motor. Compressed air could also be used with these. They were sometimes used at Broken Hill. He agreed with Mr. Harrington that there was a field of usefulness for flexible tubing. They had found that the tubing had sometimes deteriorated by the time it reached Broken Hill. For this reason it had sometimes been disappointing. It had the advantage of being quickly installed and quickly removed when firing. He thought that galvanized sheeting would be better where permanency was required and the flexible tubing where damage was likely to be incurred by blasting. Professor Chapman had referred to the katathermometer. He wished to say that it was constantly used in Broken Hill and was regarded as the best means of measuring the cooling power of the air. The wet bulb thermometer was not satisfactory, because in order to obtain satisfactory readings it was necessary that the air should pass the bulb at a rate of one hundred and eighty metres (six hundred feet) a minute.

PROFESSOR H. G. CHAPMAN referred to the freedom of many miners from miners' phthisis. In Broken Hill they had found that 60% of miners who had been working underground for thirty years, were free from silicosis. He would be grateful for suggestions as to why this freedom existed. He could not suppose that a discrimination was exercised by the body in regard to dust. It must be due to some mechanical condition in the respiratory tract by which the dust did not penetrate to the lungs. The second point to which Professor Chapman referred, was the great difference which apparently existed between the silicosis as it existed in South Africa and that found at Broken Hill. In South Africa the first appearance of the disease was in the alveoli; subsequently it appeared round the peri-bronchial tubes. In Broken Hill they had not seen an area of the lung characterized by blocking of the alveoli. The dust had been entirely distributed along the peri-bronchial tubes. He also wished to recognize the enormous debt that they owed to the mine owners in Broken Hill and to men like Mr. Warren and also to the miners' union. Without the whole-hearted cooperation of these people it would have been impossible to have carried out the work.

PROFESSOR C. J. MARTIN, F.R.S., said that he wished to support Mr. Warren in his remarks in regard to the katathermometer. It was an extremely useful instrument and by its agency the two factors determining the rate of loss of heat were integrated, namely the wet bulb temperature and the velocity of the air. The criticisms advanced against it were due to its smallness and its sensitiveness to small currents of air. It was, therefore, sometimes necesary to make a large number of reading. In mines more consistent results were obtained than on the surface.

MR. WAINWRIGHT said that in New South Wales Broken Hill was the only district in which compensation was offered to miners.

Hookworm Disease in Australian Mines.

DR. W. C. SWEET read a paper entitled "Hookworm Disease in Australian Mines." Dr. Sweet said that, although hookworm disease was a disease of tropical and sub-tropical climates, the conditions existing in mines were such that miners of all countries had been found to be affected. In 1920, 58,142 persons in the Commonwealth of Australia were engaged in mining. He reviewed briefly the origin

of the activities of the Australian Hookworm Campaign and explained the methods of working. Mines in Australia might be divided into two groups, the metalliferous and the coal mines. Dr. Sweet summarized the findings of the Hookworm Campaign in regard to the infestations in miners. A total of 10,228 miners and mine employees had been examined from one hundred and fifty-six mines in six States. Of this number 646 had been found affected. This corresponded to 6.3%. No endemic disease had been discovered in miners connected with mines of all descriptions in Victoria, South Australia, Western Australia or Tasmania. All the infected individuals had come from New South Wales or Queensland. In the metalliferous mines of New South Wales no instance of infestation with hookworm had been discovered. In Queensland metalliferous mines two infected persons had been discovered. Both these men had probably been infected in other places than in mines. The metalliferous mines of the States of the Commonwealth could thus be regarded as being free from endemic hookworm disease. In certain coal mines the state of affairs was quite different. In Queensland and New South Wales 5,063 men had been examined, of whom 644 had been infected. Of this number 635 had come from Queensland and nine from New South Wales. Of the nine men infected in New South Wales six had in all probability been infected elsewhere. The remaining three had probably been infected in the Newcastle-Maitland field. The Newcastle-Maitland mines must be regarded as being lightly infected and it was possible to acquire hookworm disease in them. Such locally acquired disease was, however, rare and did not constitute a serious problem. Dr. Sweet gave in some detail the numbers of infestations found in Queensland mines. He had come to the conclusion that a high percentage of hookworm disease occurred in the Ipswich and Burrum coal fields of Southern Queensland. The Darling Downs collieries and the Mount Mulligan mine were light endemic centres and would probably become more heavily infected unless steps were taken to prevent this. The Blair Athol coal field was not an endemic centre, but would probably become so unless preventive measures were adopted.

The cause of the spread of hookworm disease was the pollution of suitable soil with the excreta of persons harbouring the worm. The question of proper sanitation thus assumed a place of importance. With few exceptions the metalliferous mines of the country had well-established underground pan systems for the disposal and removal of excrement. These systems were sufficient, but that prevailing at Broken Hill was the only one that was entirely satisfactory. The same conditions did not apply in coal mines. In Queensland the regulations had only recently been made applicable to coal mines and in New South Wales the regulations although inadequate were not enforced. In only twelve of ninety coal mines investigated was any provision made for the safe disposal of human excrement underground. The pans provided in these mines were quite inadequate. As a consequence old workings were used as latrines and promiscuous defæcation was constant. No provision was made for waste receptacles, for safe drinking water supplies or for the men to eat away from their work.

The hookworm gained access to the body through the skin and thus the question of the clothing of miners required consideration. The habit of going bare-footed and the universal soil polution was sufficient to explain the prevalence of hookworm in certain fields. It was not clear why some mines should be clear of infection when the sanitary conditions were similar to those of infected mines. Moisture was necessary for the development of hookworm larvæ and with this in mind an investigation had been carried out into the composition of various mine waters. No useful conclusions had been reached. It was possible, however, that the presence of certain salts in the water might have an inhibitory effect on the development of the eggs. This was, of course, merely conjecture. Infected persons had been treated by oil of chenopodium and it was hoped to make yearly surveys.

Dr. Sweet detailed the recommendations made by the Hookworm Campaign in regard to the sanitation of coal mines in Queensland. He said that the issuing of the recommendations had been followed by improvement in the sanitation of two of the coal fields. The recommendations had not applied to New South Wales, for hookworm was not a problem in the mines of that State and was not likely to be. Dr. Sweet drew attention to the importance of securing the cooperation of the miners themselves and to the difficulty of doing this. There had, however, been a considerable reduction in the number of hookworm infestations in the Ipswich area. This had been revealed as a result of a resurvey of the mines in that district. The incidence had fallen from 31.5% to 6.1%. The improvement was not actually as great as these figures would indicate on account of the small number of miners who had submitted specimens on the second occasion. There had been nevertheless a considerable improvement.

DR. C. MANALANG (Philippine Islands), in discussing Dr. Sweet's paper, said that he had been working in cooperation with the International Health Board in the campaign against hookworm. As a result of his work it was probably safe to say that from 60% to 70% of the population were affected by the disease. In a population of ten million people the problem was a big one. The work of survey was almost complete in one island with an area of 415,000 hectares (1,600 square miles). In this district with its population of one million the incidence of infection was 80% in some areas and 100% in others. The personnel of the staff had not been large enough to examine specimens from every individual. They had had to be content with examining groups of specimens. In regard to one district it had been held that no hookworm infection was present. This was in the province of Mindanao. The houses there were built over the water and the inhabitants defæcated into the water. The survey, however, had shown that from 32% to 80% of the people were affected. The problem was very serious also in that it exposed large masses of the population to the possibility of contracting infective diseases on account of lowered vitality. It was doubtful whether hookworm was the only factor to be considered. Ascariasis was present in a large percentage of the population. It was responsible for much respiratory disease in children. Occasionally pulmonary œdema with death occurred and at autopsy the only pathological lesion found would be plugging of the whole alimentary tract with ascaris. Ascaris was so prevalent that its prescence had increased the risk of surgical operation. The worms had a habit of migrating and looking for injured bowel, such as that at the site of operation, and in this way peritonitis was sometimes caused. Trichinuris was also important in the Philippines. In many instances the worm was found in the vicinity of the appendix and even with its head embedded in the mucosa of the appendiceal wall. They were using carbon tetrachloride. It was effective against hookworm and ascaris, but not against trichinuris.

PROFESSOR C. J. MARTIN, F.R.S., said that he had a personal interest in hookworm. In the early days of the investigation of hookworm he had been associated with Haldane and Boycott. They had suggested that miners' anæmia might be due to anchylostoma. Looss had discovered the method of transmission and had called for volunteers. He had allowed himself to be infected for experimental purposes. He asked Dr. Sweet what method was being used in the isolation of hookworm from fæces. He had been interested to hear Dr. Manalang's experiences with ascaris. The occurrence of respiratory troubles in children could be explained by reference to the life cycle of the parasite. In one phase of its life history it passed through the lungs. It produced a pneumonia which was fatal to mice and guinea pigs. He asked Dr. Sweet why hookworm was not likely to become a problem in New South Wales mines.

PROFESSOR H. G. CHAPMAN said that when working with the Technical Commission at Broken Hill it had come as a surprise to them not to find a single instance of hookworm among the miners there. It seemed certain that in Broken Hill hookworm must have disappeared. Of one thousand Cornish miners in the locality not one had brought hookworm disease to Broken Hill. When the migrations of miners were considered it was surprising that no hookworm had been found. He asked Dr. Sweet whether he know anything of the disappearance of hookworm in infected persons. He also said that it should be

possible to use chemical disinfection of excreta in mines. He had investigated a pan system in which 10% caustic soda was used. The basis of the system was the use of a revolving grid by means of which the mass soon became viscid. It had been subjected to exhaustive tests and had proved satisfactory.

DR. SWEET in reply to Professor Martin said that the mines in Newcastle were as old as any in Australia. Hookworm had been repeatedly introduced and had not been able to gain a foothold. He held that there were natural conditions that prevented its spread. In reply to Professor Chapman Dr. Sweet said that it was probable that hookworm would die in an individual in ten years. Three months was probably the longest time that eggs could live in the ground. In regard to chemical disinfectants the main difficulty was the expense. Another difficulty was that of adequate supervision. It was difficult to find any person who could be trusted to undertake the duty. He was of the opinion that the most satisfactory method was that of the pan system with proper burial. In reply to another question by Professor Martin Dr. Sweet said that the method used for detecting hookworm ova was that of Willis. In this method a small tin was used to hold the specimen of fæces. This was stirred up with concentrated salt solution and allowed to stand for five minutes with an inverted slide in contact with the top of the mixture. The slide was then removed and examined for ova. The method was simple and accurate. As many as two hundred specimens could be examined by one person in a day.

The Prevention of Malaria.

DR. W. M. STRONG sent a short paper entitled "A Method of Malarial Prophylaxis by Means of Quinine." Dr. Strong related his experience in the territory of Papua in regard to simple system of using quinine for the prevention of malaria. The method consisted of taking quinine bisulphate tabloids in water in doses of 0.3 gramme (five grains) three times daily every Saturday and Sunday. He held that it was necessary to avoid cold, over-fatigue, constipation and excesses of all kinds. For twenty years Dr. Strong had been travelling about in the most unhealthy parts of that country and had not been incapacitated by malaria.

Small-pox in Java.

DR. J. J. VAN LONGHUYSEN (Dutch East Indies) sent a paper entitled "The Control of Small-pox among the Natives in the Dutch East Indian Archipelago." The author pictured the disasters and distress caused by small-pox in Java in the pre-vaccination days. As early at 1804 attempts had been made to cope with the disease by means of cow-pox. A surgeon-major had been sent to Mauritius with fifteen slave children to transport the vaccine matter in active condition by the successive vaccination of one child after the other. During the British occupation of Java under Sir Stamford Raffles a vigorous system of vaccination had been introduced. This had not, however, affected more than a small proportion of the native population. Within recent years a complete system had been developed by means of which more than four-fifths of the native population had been revaccinated every five to ten years. There had been great difficulty in preparing and maintaining the potency of lymph in the tropics. Dr. A. H. Nyland had evolved a method the principle of which was that no vaccinifer should be inoculated with lymph derived from the same species of animal. Under these conditions degeneration did not take place. Three species of vaccinifers were used, the rabbit to provide lymph for inoculation of the cow-calf and the cow-calf to provide stock lymph for inoculation of buffaloes. The buffaloes provided the lymph which was used by the vaccinators. The records of the incidence of small-pox in East Java gave evidence of the efficacy of these measures. The number of cases had fallen from 14,670 in 1912 to fourteen in 1922.

Disease Distribution in the Pacific Basin.

DR. J. H. L. CUMPSTON read a paper entitled "The Disease Distribution in the Pacific Basin." He said that he had endeavoured to obtain a comprehensive survey of the position by means of a *questionnaire* sent to the health authorities of every country bordering the Pacific Ocean and of every island therein. From the replies received he had obtained the information which he put before the meeting. In regard to yellow fever he stated that with the exception of Central and South America no yellow fever existed in any portion of the Pacific region. *Stegomyia fasciata*, however, had been found to be very generally distributed throughout the islands of the Pacific as well as on the Australian coast line as far south as 32° of latitude. Plague was endemic in Asia, Dutch East Indies and South America. It had twice gained a footing in Australia. In California it had become enzootic among ground squirrels and difficulty had been experienced in controlling this potential source of human and rodent infection. With the exception of New Caledonia the island groups had been free from plague throughout known history. In regard to small-pox it was endemic in Asia and the Dutch East Indies. In most other countries bordering the Pacific it had been kept under control by vaccination with the exception of Central and South America. The islands had been free of the disease with the exception of the Marquesas. He was of the opinion that the application of modern quarantine methods would prevent introduction into islands of small-pox, plague or yellow fever. Leprosy was common in Asia, in Dutch East Indies and occurred in non-whites in North America. It was prevalent in Fiji and had spread rapidly in the Marquesas. Dr. Cumpston enumerated the places in which its occurrence was rare and said that in general more or less complete isolation was practised. Malaria was found in different forms. The benign tertian form was commonest in Shanghai, the subtertian in Hong Kong. All types were found in the Dutch East Indies. In California malaria was prevalent in two districts. In Papua the malignant tertian type predominated. In British Solomon Islands benign and tertian types were prevalent, but no quartan malaria occurred. Malaria was common in the New Hebrides, but did not occur in the Gilbert and Ellice Islands, in Fiji, in Western Samoa nor in the French Settlements. Filariasis seemed to be very frequent in Acheen in the Dutch East Indies. It occurred occasionally in Papua. In the British Solomons there was "evidently a disease prevalent of filarial origin." In Fiji 33% of the Fijians were affected with filaria. *Stegomyia pseudo-scutellaris* was the commonest culicine; *Culex fatigans* was less prevalent. It also occurred in the New Hebrides, the Ellice Islands and the French groups of islands. In Western Samoa 60% of the natives were affected, *Stegomyia pseudo-scutellaris* being the common vector. In regard to dysentery the amœbic form predominated in Hong Kong and the bacillary form in Shanghai and Samoa. The bacillary form occurred in epidemics in Papua and the French possessions. Both forms were found in Dutch East Indies, occasionally in Southern California, in the British Solomon Islands, in the New Hebrides and in Fiji. In the latter place three-quarters of the infections were bacillary in type. Hookworm was probably universal with the exception of North America and Australia. Tuberculosis was practically universal. It was not common in Western Samoa. It was the principal cause of death in Fiji, the New Hebrides and the Gilbert and Ellice Islands. It was increasing in Dutch East Indies and British Solomon Islands. Shanghai in common with Hong Kong and other parts of the Orient had escaped the ravages of the influenza pandemic of 1918-1919. Islands at which no vessels called during the pandemic had also escaped. Beri-beri was common in Asia and the Dutch East Indies in association with the rice diet. It was not a problem elsewhere in the Pacific. Venereal diseases were common, but syphilis was not found in Papua, British Solomons, New Hebrides, Gilbert and Ellice Islands or Samoa. The Fijians were not affected by syphilis. It was interesting to note that although gonorrhœa was common in Papua, stricture of the urethra was unknown. Yaws was very prevalent in Dutch East Indies, British Solomons, Fiji, New Hebrides, Gilbert and

Ellice Islands, Samoa and the French Settlements. In regard to the term tropical ulcer there was some diversity of interpretation; the replies to the *questionnaire* had been very variable.

The Extension of Yellow Fever.

DR. H. R. CARTER (United States Public Health Service) had forwarded to the Congress a paper entitled "The Chances of the Extension of Yellow Fever to Asia and Australia." He stated that there was a large part of the globe as yet free from yellow fever in which the conditions were such that if the disease were once introduced it would, if left to itself, extend and continue indefinitely. The necessary conditions existed in Southern and South-eastern Asia, the Philippine Islands, Straits Settlements, East Indies and Australia, together with nearly all the islands of the pacific. If the infection were introduced into these regions, it would probably be found that Australia, the Straits Settlements, Japan and some other countries could and would adopt measures to protect their inhabitants and eliminate the infection. This would not, however, be done by all and there would result an unspeakable calamity to the country attacked. In addition it would be a continuous menace to all other countries with which it had communication.

Although there was only one species of mosquito, *Aedes* (*Stegomyia*) *ægypti*, which was a vector for the disease in America, it was possible, judging from analogy with the conditions seen in regard to malaria, trypanosomiasis and other insect-borne diseases, that other allied species might be present in Asia and Australia which would carry the infection. This would increase the difficulties of the problem. At the present time Australia was not threatened seriously with yellow fever by any direct route, but were yellow fever introduced into south-eastern Asia or any of the islands, the infection would be permanent and a grave risk to Australia. The measures taken in Central America insured that every vessel left there free from infection. The Pacific ports of America were at present free of infection and the only risk of introduction of yellow fever into Asia and Australia was an indirect one from the possible re-infection of these ports from Mexico and Central America. Dr. Carter discussed the various trade routes to Asia and Australia and concluded that, although the risk of the introduction of yellow fever into Australia was small, it was nevertheless too great.

Dysentery in Papua.

DR. W. M. STRONG (Papua) forwarded a paper entitled "Dysentery in the Territory of Papua." He stated that serious epidemics of dysentery of the bacterial type had occurred in the past. With improved methods of treatment the results at the present time were more satisfactory. The disease had been unknown in the Territory until 1889, when it had been introduced by Europeans or their coloured followers. Dr. Strong illustrated the effects of the introduction of a disease into a new district by referring to the incidence of dysentery in 1910 at the time of the opening up of the Lakekamu gold field. Among a population of seven hundred persons four hundred and fifteen had been infected and one hundred and sixteen had died. The methods of control consisted in the most rigorous sanitation with disposal of all human and other refuse on modern lines. Amœbic dysentery was unknown in Papua.

Common Diseases of the Samoan.

DR. J. S. ARMSTRONG (Samoa) read a paper entitled "The Common Diseases of the Samoan." He confined his remarks to that portion of the Samoan group under the mandated control of New Zealand. After giving an interesting account of the general habits of the people and the arrangements of their dwelling places, he said that the open thatched dwelling was becoming replaced by corrugated iron structures encumbered with European furniture. The natives were also wearing European clothing and did not in the least understand the necessity of changing their clothing when it became wet. The prevalent diseases were hookworm, filariasis, dysentery, measles, pneumonia, tuberculosis and leprosy. Leprosy had been introduced by a half-caste Samoan in 1892. Since that time thirty-nine persons had become infected. A water supply system was being installed on sanitary lines in the principal villages and the natives were required to find one-third of the cost. It had been found that they appreciated and valued a system, thus partly paid for by themselves, more than one provided wholly by the Government.

Hookworm Campaign in the Philippine Islands.

DR. C. MANALANG (Philippine Islands) read a paper entitled "Hookworm Campaign in Cebu Province, Philippines." Dr. Manalang gave an interesting summary of the methods used in the hookworm campaign in the Philippine Islands. No sewerage systems were in existence in the province and for this reason it was to be expected that general soil pollution with excreta would occur. The arrival of the party of examiners in a district was always made known to the inhabitants by *bandillo* (a public proclamation by a town crier). On the first day of the visit the natives generally crowded round and only one of their number would submit to treatment. If the result were spectacular enough, many more would come forward on the following days. The spectacular results necessary for this increased attendance was the appearance of a large number of ascarides in the stools of the volunteer. Ascaris was very prevalent and more spectacular in its appearance than hookworm. A laboratory was set up in some conspicuous place and the microscopical index of some fifty or more stools determined in regard to hookworm. If the ova could not be found by direct smears, they were concentrated by the Cropper and Row method. Prominent people in the community were then invited to inspect the ova and a demonstration of larvæ and adult hookworms was made. Lectures were delivered on the life cycle of the parasite and on the general subject of the disease. The severity of the infection by hookworm in a district could not be determined by the microscopical index alone. It could best be ascertained by estimating the screen index. In order to determine the screen index a certain number of stools taken at random were screened and the number of individuals from whom adult hookworms had been found, was divided by the number of individuals examined. At the same time the approximate number of worms obtained from individual fæces was noted. If the screen index were compared with the microscopical index the heaviness of infection could best be appreciated. Thus the microscopical index in one place might be 93% and the screen index might be 62%. This showed that although 93% of the people were infected with hookworm, the infection was so light or the number of hookworms so few that in only 62% were adult worms found by screening. Carbon tetrachloride was used in treatment. The dosage was one cubic centimetre for every kilogram of body weight. Up to the present time 26,000 persons had been treated and no fatality had occurred.

Progress in the Treatment of Leprosy.

SIR LEONARD ROGERS, F.R.S., had forwarded a paper entitled "Recent Progress in the Treatment of Leprosy and its Bearing on Prophylaxis." In the opening part of his paper he stated that the chronicity and variability of leprosy made it unusually difficult to estimate the effect of treatment. It was necessary to exclude instances of spontaneous improvement and the rare instances of spontaneous arrest, while it was always necessary to remember that temporary improvement might occur merely from placing underfed lepers under favourable conditions in an asylum or settlement. Sir Leonard Rogers reviewed briefly some of the methods of treatment that had been

adopted with varying degrees of success and said that he was of the opinion that the great temporary improvement following on febrile and local reactions sometimes with extensive breaking up of the lepra bacilli in the reacting tissues indicated the desirability of trying to find some method by which repeated controlled reactions of a similar nature could be produced. This would be the most hopeful line of treatment. He traced the development of the work in connexion with chaulmoogra oil in the treatment of leprosy. In the first place its nauseating taste had prevented its being administered by mouth in sufficient doses to have more than a retarding influence on the course of typical cases of leprosy. The next advance had been the use of intra-muscular injections of the oil in the form of sixty cubic centimetres of chaulmoogra and olive oils with four grammes of resorcin. Dr. Victor G. Heiser had reported some apparent cures with this method. Dr. Heiser had suggested to Sir Leonard Rogers that he should proceed with the investigation. Sir Leonard Rogers had for some time been of the opinion that gynocardic acid consisting of the lower melting point unsaturated fatty acids of chaulmoogra oil was more effective when administered orally than the whole oil. After several endeavours to secure a soluble compound of gynocardic acid suitable for injection, he had been successful in getting made some sodium gynocardate. This was readily solucble in water and yielded better results when injected subcutaneously or intramuscularly. It had been found, however, that in this form it was too painful. As a result of experimentation he had found that a 3% solution could safely be injected intravenously with practically no pain. It had been found that such injections not infrequently produced febrile reactions with softening of nodules and the breaking up of enormous numbers of bacilli. Subsequently he had done much work with Dr. Sudhamoy Ghosh in separating the different unsaturated fatty acids of chaulmoogra oil by fractionation and testing their sodium salts in leprosy. They had found that salts of chaulmoogra acid were least soluble and the least active while the sodium salt of hydnocarpic acid had been most active. They had also found that the various oils derived from the seeds of species of *Hydnocarpus wightiana* and other varieties of hydnocarpus contained more hydnocarpic acid than true chaulmoogra oil from *Taraktogenos kurzii*, although soluble preparations of the whole oil of either were quite satisfactory in the treatment of leprosy. He had then made a sodium salt of the unsaturated fatty acids of cod liver oil which he had called sodium morrhuate. It had been far less irritating both subcutaneously and intravenously than gynocardates and hydnocardates. A trial in three hundred cases of leprosy had shown that equally good results could be obtained with both sodium morrhuate and sodium hydnocarpate. This had established the important principle that other oils than chaulmoogra might yield effective preparations. This had been confirmed later by the production of sodium soyate from soya bean oil. Dr. Muir had since succeeded in making similar preparations from linseed and olive oil. Sir Leonard Rogers quoted statistics in regard to the treatment of patients by these preparations. He then referred to the work of Dean and Holdnann in preparing ethyl esters of the fatty acids and said that they had the advantage over the sodium salts in being more suitable for intra-muscular injection. The ethyl esters were not altogether new preparations. The principle to be aimed at in using these drugs was to produce a slight general reaction and a slight local reaction and to interrupt the injections until these reactions had completely ceased. In endeavouring to explain the mode of action of the soluble fatty acid preparations he referred to the work of Walker and Sweeney in 1920 on the action of various fractions of the fatty acids of chaulmoogra oil *in vitro*. They had been found to destroy the bacilli by prolonged action *in vitro* at blood heat in dilutions up to one in 100,000. This had not explained the results often seen from the injection by the intravenous route of one small dose of sodium hydnocarpate and was not applicable to the results obtained with sodium morrhuate and sodium soyate which had no action on acid-fast bacilli *in vitro*. The findings of Shaw-Mackenzie that both sodium hydnocarpate and sodium morrhuate doubled the activities *in vitro* of intestinal lipases had led Sir Leonard Rogers to investigate the blood lipases in leprosy. He had come to the conclusion that the soluble oily preparations acted by increasing the lipases in the blood which in their turn broke up the bacilli, and, by setting free their antigens, gradually produced immunity.

In conclusion Sir Leonard Rogers touched on the economic aspect of the problem of leprosy both in regard to the influence of improved treatment on the prophylaxis of leprosy and the value of improved treatment in attracting patients while they were suffering from the disease in its early stages.

The Value of Anti-Dysenteric Serum.

A PAPER had been forwarded by DR. F. H. BEARE (Adelaide) on the value of anti-dysenteric serum in the treatment of dysentery of the bacillary type. He traced the advances which had been made in the use of anti-dysenteric serum since its introduction by Shiga in 1898. Many American writers had stated that it was not of much assistance in the treatment of dysentery in children. Dr. Beare quoted the results that had been obtained in Adelaide with the use of serum and referred to the results obtained by other Australian workers in this regard. He held that the results obtained justified the use of serum in children. Two things were necessary. The one was to use a polyvalent serum and the other to administer it early in the course of the disease.

The Industrial Importance of Intestinal Diseases.

A PAPER by PROFESSOR F. G. HAUGHWOUT (Bureau of Science, Manila, Philippine Islands) entitled "The Industrial Importance of Intestinal Disease" was read by DR. C. MANALANG. The author pointed out that the problem of intestinal diseases as a group contributed a heavy morbidity and a high mortality that often passed unnoticed. Such diseases constituted the greatest daily problem in the tropics. He emphasized the necessity of training medical officers in regard to laboratory diagnosis. Amœbæ and endothelial cells were often confused. The subject was important from an economic standpoint. Failure to recognize disorders resulted in economic troubles through the spread of an unrecognized infection, through the heightened mortality resulting from mistaken diagnoses and through the utilization of large quantities of expensive drugs in the treatment of conditions for which they were not intended.

The Depopulation of the Pacific.

DR. J. H. L. CUMPSTON also read a paper entitled "The Depopulation of the Pacific." Dr. Cumpston said that changes were occurring in the Pacific which were liable to result in serious possibilities. In some instances difficulties had already developed. The islands of the Pacific were being repopulated by varying breeds of Asiatic coolies. The higher types of the same races would eventually be introduced and the final phase might easily lead to serious international conflict, either diplomatic or military. There could be no doubt as to the fact of depopulation. Dr. Cumpston quoted Chantemesse and Mosny in regard to New Caledonia. In 1853 the Kanakas had numbered 70,000. As a result of tuberculosis, leprosy and alcoholism as well as deliberate birth restriction the population in 1900 had been about 19,000 in New Caledonia and 12,000 in the Loyalty Islands. Sir Everard im Thurn had said that the depopulation was undoubtedly the result of the settlement among the natice races of Europeans. Dr. Rivers had investigated the subject and had cited the causes as the introduction of infective diseases, the introduction of social poisons, the introduction of firearms and the profound disturbance of native customs and social organizations. As a remedy against the last cause of racial decay it had been suggested that the native should be given a real interest in the economic development of his country.

Modern preventive medicine could do much to bring the diseases under control to a very considerable degree. There were two aspects of the question. The first was the protection of the islands from external infections and the second was the control of the diseases already established. The history of the Pacific contained many tragedies. The white race as a result of centuries of immunization had developed a degree of resistance which enabled the majority to survive. The native races had none of this immunity and infections killed them rapidly. Dr. Cumpston referred to the story of King Thakombau, of Fiji, who on returning from Sydney to Fiji in 1875 to consult with his chiefs had taken to the islands an infection of measles. This epidemic had killed 26% of the entire population. The Reverend W. Durrad had stated that the "Southern Cross," the supply vessel of the Melanesian Mission, had been one of the chief agents in the distribution of pneumonia germs. Dr. Cumpston also told the story of how one small trading vessel had left New Zealand during the pandemic of 1918 and had infected the inhabitants of three island groups and had produced a scourging epidemic with an appalling mortality. In Nauru a single Chinese leper had landed on the island in 1911 and after twelve years there were nearly fifty lepers in a population of eighteen hundred. He instanced one achievement. During the influenza pandemic of 1918 a quarantine detention of seven clear days had been imposed on all vessels leaving Australia for the Pacific ports. Those islands trading exclusively with Australia had escaped infection. The late Sir William Macgregor had summarized the situation. He had said that although the quarantine practices in Australia were firmly established, the strictest quarantine might fail and that in any case there remained the serious question of the diseases already domesticated in the islands. Unless an early means were taken to minimize their effects, the inhabitants of many islands would before long be reduced to the verge of extinction. Dr. Cumpston said that the issue was clear. The conservation of the native races must be undertaken. They were only concerned with the disease factors. The islands were divided into five groups. The problem could be adequately handled with the establishment of five properly equipped bases with an adequate equipment, such as had been suggested by previous experience. The question of personnel was an important one.

In a supplementary note Dr. Cumpston said that the question of the training of men was of considerable importance. It was useless to send to the tropics as medical officers men fresh from graduation who had had no experience whatever of tropical diseases. He held that the time had come when expeditions should not be sent for the acquisition of more knowledge, but for the treatment of conditions existing in various centres. The right body to attack the question was the International Health Board and the centre of the scheme from a geographical point of view should be Townsville.

DR. A. HONMAN in discussing Dr. Cumpston's papers said that he regarded the question of the depopulation of the islands as a serious one. He did not agree with the statement that was sometimes made in regard to the responsibility of venereal disease for the depopulation. The food question was often of considerable importance. He instanced the condition of affairs that had obtained at New Island. A severe drought had been present for eight months and the majority of the inhabitants in the high lying areas had been cleared off. The younger members of the community had been able to get down to the coast, but the others had died of starvation. He held it as an axiom that if the people were given an abundance of good food they would increase in numbers. In the smaller islands recruiting had done more harm than disease. Not one man in ten who was recruited, ever returned to his island. In the smaller islands the temperature was more placid. In the larger islands in the south considerable variations of conditions were encountered and many natives got diseases and died. Dr. Honman discussed the question of black water fever among white persons and said that in New Island four had died of this disease since the beginning of 1923.

DR. H. R. JOHNSON (Hong Kong) referred to the activities of the Colonial Office in regard to the requirements for medical officers in the tropics. Every medical officer was required to attend a course of instruction in tropical diseases and to pass an examination in the subject. A chair of tropical medicine had recently been established in Hong Kong and he thought that good work might be looked for in connexion with it. In regard to black water fever which had been mentioned by Dr. Honman, he had had some experience of this disease in Africa and in China. It was undoubtedly connected with malaria. This disease was usually a complication of malaria. On the other hand, he had seen black water fever arise without any reference to malaria and with complete absence of parasites from the blood. It was a question as to whether malaria was the cause of black water fever or merely one of the conditions necessary for its appearance. Was black water fever due to a specific organism or was it merely what was known as paroxysmal hæmoglobinuria? He had seen a patient who had never been out of England suffering from a condition indistinguishable from black water fever as he had seen it in China. In regard to its treatment he did not think that quinine was useful but actually harmful. He had not been unsuccessful in dealing with the condition. He had treated forty patients without the occurrence of a death. Of the utmost importance were rest and sleep and the drug which was a sheet anchor in the treatment was morphine. Adequate nourishment was also necessary. In regard to malaria he had seen many children under the age of five years supposedly suffering from sunstroke who were really suffering from cerebral malaria.

PROFESSOR C. J. MARTIN said that Dr. Cumpston had presented the problem on a broad and large basis. It was not only necessary to deal with the prevention of extension of disease, but to deal with the problem of disease where it already existed. The first aspect meant some sort of quarantine. It had perhaps been a pity to have upset the old quarantine previously existing in the islands, when the newcomer had been cooked and absorbed into to the community after sterilization. He had not sufficient knowledge to state whether quarantine measures could be carried out, but he supposed it would be possible to administer such a service. Dr. Cumpston's idea in regard to the International Health Board was perfectly sound. Of course, money was necessary. He did not suppose that much money would be obtainable from either England or France. From the way the overseas representatives were being treated at the Congress it looked as if Australia had plenty of money. Of course, America had plenty. That knowledge was common property. The resources of the Rockefeller Foundation were not unlimited, but he thought that if the interest of those at its head could be attracted, it would be the best agency to attempt such a scheme. In regard to the diseases already in the islands it was a question of the best way of dealing with them. Much had been said of laboratories. A laboratory was merely a workshop. If a pathologist were wanted to work, he should not be separated from the work of a practical physician. A pathologist should be a physician who used particular tools. Great disadvantage resulted from the divorce of these activities. Pathologist and physician should work in consultation.

DR. J. S. ARMSTRONG (Samoa) said that in Samoa they were trying to make the system of port work more extensive to cover all the vessels trading between small groups of islands. At present they got reports from Australia, New Zealand and American Samoa. In regard to the London School of Tropical Medicine he stated that when he had been in London on the last occasion, all those in authority at the School had been keen on getting men to remain in the tropics and not on sending expeditions out for limited periods. The financial trouble was important and money was required to establish posts for any length of time in tropical countries.

A JOINT SESSION to the Section of Anthropology and Ethnology and the Section of Hygiene was held on August 21, 1923, to discuss the causes of the decline of the native

races in the Pacific Islands. PROFESSOR C. J. MARTIN, F.R.S., occupied the chair.

DR. R. W. CILENTO sent a most interesting paper entitled "The Depopulation of the Pacific" in which he discussed the principal phases of the question from the medical aspect. There were two prominent features to be remembered in connexion with the populations of the Pacific regions. In the first place there was the fact of their considerable numbers as emphasized by the early explorers, their high state of development and their great natural abilities. The second feature was their constant and rapid diminution since the white man had taken possession. The Tahitians had been estimated in 1774 to number 150,000 and in 1899 they had numbered merely 10,000. The Maoris had decreased in number from 120,000 in 1840 to 40,000 in 1891. In Fiji, only seventeen years after the British annexation, it had been necessary to hold a Royal Commission to inquire into the causes of decrease of the population. Dr. Cilento referred especially to the mandated territory of New Guinea of which he had had several years' intimate experience. In that territory the German authorities had been much and continuously concerned in regard to the decrease of population. In one district to his personal knowledge the excess of deaths over births in one year in a population of 9,600 had been 268. This had been by no means a bad year. Dr. Cilento attributed this decline to three things: disease, economic and social factors and psychological factors. The diseases were either of local origin and endemic or had been introduced from outside and were epidemic. Local diseases were caused largely by faulty hygiene and sanitation. Enormous numbers fell victims to insect-borne diseases. Tuberculosis and other pulmonary diseases were extremely common and malaria caused a large mortality among children before the age of ten years. Hookworm was universal and reduced the resistance of the individual to other diseases. In some island groups filariasis affected 20% to 25% of the natives. Gonorrhœa was extremely prevalent and yaws in many districts attacked 100% of the children. Dr. Cilento laid great stress on the fact that all these diseases were within the province of preventive medicine. The methods of prevention in regard to many of them were well established. Influenza, dysentery and measles had all been introduced into one or more of the islands with the most tragic and appalling results. As a result some attention had been paid to them, but the more chronic diseases were allowed to proceed with slower but equally certain steps. Leprosy had been introduced into almost all groups of islands and had an unimpeded and insidious spread. One German investigator had reported on the decline of races in German New Guinea and had summed up the situation by stating that the native population was not degenerate; it was sick.

Among the economic and social factors were indisposition on the part of the natives to have families and consequent abortion and infanticide, the existing of unnatural practices, venereal diseases, the recruiting of males for labour in other islands and the cessation of tribal hostilities. Dr. Cilento said that the ultimate fate of the Polynesian and Melanesian races would be extinction unless measures to cope with these factors were brought into operation at once. He dealt mainly with the disease factors and said that the necessary measures included an efficiently organized quarantine service and a fully trained medical force with a well staffed series of laboratories. He laid particular stress on the necessity for every medical officer sent to the tropics to undergo a special course of training in tropical diseases. The Tropical Institute at Townsville was the natural centre for this work.

HIS EXCELLENCY JUDGE MURRAY, Administrator of Papua, read a paper entitled "The Population Problem of Papua." There were, he stated, certain conditions which tended towards preservation of life and the increase of population and other influences, some of a subtle character, which had a contrary effect. White settlement had caused certain moral and material disturbances in the life of the native. The moral disturbance was caused by the disappearance of old native traditions and customs which had been the refuge and protection of men and women for generations in times of stress. The material disturbance was caused by the alteration in their activities and mode of life. Life was not so strenuous as it had been. The abolition of tribal warfare had also prevented much loss of life. The native had believed that every natural death was caused by an enemy and there was a form of *vendetta* by which a life was demanded for every life that had been lost. Among the other good effects of white settlement were improved sanitation, the medical treatment of existing diseases and also the improvement in means of communications and transport. The latter was the means of affording relief in times of famine, although it was not an unmixed blessing on account of the fact that the spread of epidemics was thereby facilitated. In regard to the most obvious ill-effects of civilization these were disease, alcoholism and drugs, particularly opium. The use of alcohol and opium by natives was forbidden and the regulation was rigidly enforced. In this the Government had the unanimous support of the white residents. The danger from diseases was more difficult to combat. Much could be done by quarantine methods, but these sometimes failed and compulsory examination and treatment was occasionally necessary. The natives were beginning to realize the benefit to be derived from medical treatment and were coming in voluntarily. In regard to European clothing most people would agree with the Reverend W. J. Durrad, that of all the evil customs introduced by civilization the wearing of clothes was probably the greatest. The practice as far as it concerned the upper part of the body had been forbidden. There was also a danger that the suppression or modification of native habits and institutions would cause the native to lose interest in life and if he had nothing to live for, he would die. There was difficulty in keeping native customs and institutions alive; some of them, of course, were clearly out of the question. Such were cannibalism and head hunting. In some islands head hunting had been the keystone of social structure. The *kula*, a trading enterprise conducted under strict rules and along a definite route, was an example of those customs which it would be well to foster, but more modern methods were bound to supersede it. Other useful or even harmless customs should not be discontinued, unless something were at hand to put in their place.

In regard to the means which should be used to counteract moral and material disturbances, it should be remembered that contact with the white man inevitably undermined his confidence in the native's ancestral religion and the magic of his tribe and made his traditionary institutions appear rather absurd, at any rate to the younger men. The true policy was to substitute some other interests in life for those which were going or had already gone. Such an interest was that to be derived from manual labour and by this was not meant labour in the service of an employer. On this point he could not agree with Dr. Felix Speiser that the natives should be recognized as servants and treated with humanity and kindness. This was exactly the opposite to what should be done. If they were encouraged and at least given the opportunity of rising to something better than servants, the white man would be contributing to the primary cause of their dying out. An attempt was being made in Papua to compel the native to work for his own benefit. With the introduction of the native tax in 1919 it had become possible to deal with the matter in a comprehensive manner.

The effects of moral disturbance was beyond governmental control. A small department of anthropology had been established in Papua and it was hoped that it would be the means of suggesting methods of reconciliation of the old and the new. Generally speaking the moral disturbance was a matter for missionary influence. Speaking as an administrator he held that missions were in this regard so valuable as to be absolutely indispensable. Most people allowed themselves to underrate the enormous moral and social force of Christianity and consequently underestimated the effect of Christian missions on native races. In addition to the prohibition of European clothing and native plantations, a baby bonus had been established and it was having the effect of making large families the fashion. Speaking generally of the larger villages of the Central Division and the Gulf of Papua

there was an increase in population which more than equalled the decline in the smaller villages in the east.

DR. P. H. BUCK, D.S.O. (New Zealand) read a paper entitled "The Passing of the Maori." In the opening part of his paper Dr. Buck referred to the writings of many who had foretold the early extinction of the Maori race. He then proceeded to give statistics with regard to the present Maori population. He showed that since 1896 there had been a steady increase in numbers and that the percentage of Maoris under the age of fifteen years to the total Maori population had been forty in 1921, whereas in 1891 the percentage had been only 34.1. Dr. Buck traced in interesting fashion the influence of the Maori wars on the population and said that these wars had been the means of showing the British people that the Maori was a person of some independence of spirit who could be led but not driven. He showed how the various phases of civilization had been accepted by the Maori. The theory of rapid extinction had been disproved, but it did not follow that the Maoris would continue to exist as a distinct race for an indefinite period. The Maori race might be absorbed, but absorption did not mean extinction. Anthropological study showed that when a race survived extinction and was not able to maintain a certain isolation, it became merged in the general population.

DR. W. C. SWEET said that there had been a great similarity in the facts concerning many islands and it was well in this connexion to recall what Dr. Cumpston had said in regard to cooperation. Dr. Sweet referred to several examples from the papers read in which the advantages of cooperation had been shown. Dr. Manalang had instanced the cooperation between the International Health Board and the Philippine Health Service and Dr. Carter had referred to the active cooperation between the International Health Board and the Government of Central America. Dr. Sweet traced in detail the activities in regard to yellow fever in Central America and then proceeded to indicate the manner in which the Commonwealth Government of Australia and the International Health Board had taken concerted action in regard to hookworm. It was important to note that the International Health Board had appointed Dr. Lambert as director of anti-hookworm work in the Pacific islands. Dr. Sweet pleaded for further cooperative work and said that it would be a wise action for the Congress to recommend unity of action of the governments concerned in the Pacific either with or without the International Health Board.

CAPTAIN PITT RIVERS in discussing the papers laid stress on the necessity of making a distinction between race and population. The term race implied identity and constant homogeneity; it meant ethnical segregation. In the mixing of two different races it was found that after a decrease in the native race an arrest came. This was frequently followed by an increase in numbers. It was not to be supposed that the increase was due to immunization of the native race to changed conditions; the increase was due to the progressive infusion of alien blood.

DR. A. H. HORSFALL said that it was not always true that when people living under tribal rules came under the influence of a foreign government, there was a loss in population. He referred to some of the natives in South Africa. There had in bygone days always been a large decrease in population as a result of intertribal warfare. Thus, in Basuto Land where there had previously been a population of only 30,000, there was a population of half a million. He held that if the native was not adaptable to new conditions, he would die out.

MR. CHINNERY said that as far as New Guinea was concerned it was not a question of adaptability or otherwise. The native had proved himself adaptable. He thought that there should be more research into the life of the native and into village interests generally.

After another speaker had said that the problem was an economic and sociological one and not a medical problem, DR. J. H. L. CUMPSTON said that preventive medicine if properly applied could save the native races. He made the very practical statement that the thousands of natives dead of measles in one group of islands were not in a position to adapt themselves to anything.

DR. A. C. HADDON, F.R.S., said that the problem in his opinion was both a sociological and an hygienic one. He referred to sociology in its broadest possible application.

PROFESSOR C. J. MARTIN, F.R.S., said that in his writings Dr. Rivers had laid stress on the loss of zest in life of the Polynesians. Judge Murray had referred to the same thing. He could not accept boredom as the primary cause of death. The disturbance and upsetting of social machinery undoubtedly played an important part. One cause of loss of population had been shown by history to be famine and pestilence. The British race were often held responsible for the large increase of population in India because they had interfered in the quarrels of the native races and had introduced medical sciences and so forth. The real reason was that organization and railways had stopped famine. This meant that a stable organization was necessary before the machinery of hygiene could become operative. Medical science could certainly stem the tide of trouble caused by many diseases, but the extent of its operations would depend on the existence of a stable society. This was where sociology came in. Without this quarantine measures and medical officers would be of no avail. For this reason he held that the problem was as much anthropological as medical.

The following motion was proposed by DR. J. H. L. CUMPSTON and seconded by MR. E. L. PIESSE and carried unanimously:

> That the scientific problem of the Pacific which stands first in order of urgency, is the preservation of the health and life of the native races by the application of the principles of the sciences of preventive medicine and anthropology.

SYDNEY SESSION.

INAUGURAL PROCEEDINGS.

IT was thought by a number of persons that the activities of the members of Congress in Melbourne would have had a tiring effect on them. This did not appear to be the case for on the morning of August 24, 1923, the Great Hall of the University of Sydney was the scene of a most enthusiastic inaugural meeting.

A stirring address of welcome couched in most happy terms was delivered by HIS EXCELLENCY SIR WALTER DAVIDSON, Governor of New South Wales. In the course of his address His Excellency said that the chief need of science in Australia at the present day was the more liberal endowment of pure science and a generous provision for travelling scholarships and fellowships as well as for further endowment of local research.

SIR GEORGE FULLER, the Premier of New South Wales, welcomed the delegates to Sydney on behalf of the people of New South Wales. He referred to the benefits conferred by scientists on the primary industries of the country.

WORK OF THE SECTIONS.

As with the Melbourne Session our report is concerned chiefly with the transactions of the Section of Hygiene. We have, however, included two papers of special interest from the Section of Anthropology and Ethnology and a report of a general discussion of Congress on the organization and coordination of research in the Pacific. The interest shown by members of the medical profession in Sydney was somewhat better than had been case in Melbourne. The attendance was nevertheless much below what it ought to have been. It was perhaps a pity that so many contributors of papers read summaries of work that had already been published. The occasion and the audience surely demanded something different.

Climate and Human Efficiency.

PROFESSOR C. J. MARTIN, F.R.S., delivered his address as President, entitled "Climate and Human Efficiency."

In his opening remarks Professor Martin said that he wished to acknowledge the courtesy of the Section in electing him as chairman for the Sydney Session. It was not altogether, however, an unmixed blessing, for while he had come prepared to say something in regard to the mechanical aspect, namely climate in relation to its limiting effect on muscular work, the subject had grown and he was confronted with the task of speaking on climate and human efficiency. In these circumstances he proposed to discuss the subject of climate on broad lines and postpone his original paper till a later date.

Most people had profound convictions about the effect of climate on them. Some of these effects were due to superstition, some to want of adaptation and some to unknown factors. It behoved scientists to be humble, for much in connexion with the subject was unknown. The word climate had originally referred to the inclination of the sphere with respect to the horizon. It was from variation in this inclination that inequality of the day and night was produced. Ptolemy had divided the surface of the globe into parallel zones or climates according to successive increases of quarter-hour periods on midsummer day. In its modern acceptation the word climate meant the condition of the medium in which man lived, *id est* the atmosphere in so far as it influenced animal and vegetable life. It also had reference to the amount and nature of radiant energy impinging upon man himself as well as upon the surface of the earth at any particular point.

The effect of climate on man was twofold in nature. It was direct, both physiological and mental, and it was also indirect. In regard to the indirect effects of climate on man it was to be remembered that man was not alone. He was accompanied by numerous companions both of the animal and vegetable kingdoms. The effect of climate on man's companions was important. Thus the nature of the vegetation determined his food supply to a large extent. It was perfectly true that man could live as a carnivorous animal. This was done by the Esquimos. Only when civilization had attempted to interfere with these people and the traders had exchanged currants and white flour for silver fox furs had beri-beri broken out amongst them. Man's liability to diseases was influenced to a large extent by climate, diseases which were the result of the efforts of humbler organisms to gain a living at his expense. These were merely examples of parasitism. The parasites were of three kinds: bacteria, protozoa and helminths. In regard to bacteria an increase in temperature meant an increase in rate of reproduction. Light and dryness were inimical to them. Professor Martin illustrated the effect of temperature on the multiplication of a typhoid bacillus dropped into a tumbler of milk and showed that forty-eight generations would take place in twenty-four hours at 30° C. and only eight at 10° C.. One bacillus might become 2.5×10^{11} at the former temperature and only a few hundred at the latter. Climate also affected disease by propitiating the carriers of disease. For example, flies and mosquitoes bred more rapidly and were much more numerous and active in hot, moist than in cold climates. Plague fleas apart from the host throve best in a moderately warm climate, whereas they rapidly succumbed to a very hot, dry climate like that of northern India in the hottest part of summer. As an example of the protozoa Professor Martin referred to the malarial parasite. Heat hastened the development of the parasite in the mosquito. In regard to helminths he referred to hookworm. Here again heat was necessary for the development of the larvæ. For very few of the so-called tropical diseases was a tropical climate necessary. Plague, cholera, leprosy, dysentery and malaria which figured largely in a text-book on tropical medicine, had once been rife in northern Europe. A certain degree of warmth and dampness might favour their spread directly or indirectly and cold and drought might hinder their dissemination, but their disappearance was due to other causes. These were improved conditions of life and sanitation. The striking instances of essentially tropical diseases were those dependent for their transmission upon some insect with a limited habitat, *exempli gratia* yellow fever, dengue fever and sleeping sickness. The indirect effects of climate could be to a large extent obviated, as was evidenced by the reduction in the death rate which had been brought about by means of preventive measures in the Panama.

Turning to the direct effects of climate on man Professor Martin drew attention to the variations of the atmosphere in regard to amount, composition and movement. The quantity of atmosphere was indicated by the barometric pressure. If the barometric pressure at sea level were taken as one, it would be 0.75 at a height of 2,134 metres (7,000 feet), it would be 0.5 at a height of 5,486 metres (18,000 feet) and 0.33 at a height of 8,230 metres (27,000 feet). The barometric pressure affected some people to a considerable extent. A low barometric pressure, such as that observed at and above a level of 4,000 metres, was of interest only to mountaineers. At a height of 2,000 metres the number of red blood corpuscles was considerably increased, but the mechanism of this was not understood. In regard to the composition of the air the prime variations occurred in the oxygen, carbon dioxide and aqueous vapour content, as well as the presence of particulate matter. The movement of the atmosphere was important for the rate of heat loss was conditioned in this way. Movement of the air by varying rate of heat loss also acted as a cutaneous stimulant.

Another important factor in climatic conditions to be considered was that of the effect of radiant energy. Coming from the sun were radiations of wave lengths varying from 0.3μ to 3μ. The visible part of the radiations varied in length from 0.4μ to 0.6μ. In regard to the amount of radiant energy this was composed of ultra-violet rays to the extent of 1%, visible rays 19% and infra-red rays 80%. The solar energy per square centimetre was measured in gramme calories per minute. The amount of radiant energy reaching the body depended on the obliquity of the sun and the transparency and depth of the atmosphere. The transparency varied with the prevailing conditions and with the altitude. Professor Martin showed how this might be worked out mathematically. He had estimated his shadow on several occasions and had found that it varied from one thousand square centimetres to five thousand square centimetres with the sun at an altitude of 48°. He showed that with this altitude the radiant energy impinging on his body might be as much as 3.5 calories per minute per square centimetre or three times his basal metabolism on a bright clear day. The amount of this heat absorbed by the skin was unknown; probably not one-half was absorbed. A black skinned man would absorb more. Clothes absorbed much of the radiant energy and either passed it on to the body or dissipated it into the surrounding air according to circumstances. Ultra-violet light only penetrated as far as the deeper layers of the epidermis, if this was pigmented as in the case of a well-tanned skin. If it reached the cutis it produced sunburn. Visible light penetrated much more deeply and the infra-red rays more deeply still. Ultra-violet light was a powerful tissue irritant and if present in sufficient strength, was cellucidal. It produced dermatitis and blistering and finally in some individuals resulted in the development of a layer of pigment in the deeper layers of the epidermis. More ultra-violet light was encountered as mountains were climbed. For this reason and the reflexion mountaineers were tanned more quickly on glaciers and snow than were individuals at the sea level. There were other effects of ultra-violet light. Professor Martin referred to the effect of ultra-violet light on the growth of rats deprived of accessory food factors and showed graphs on the screen which had been obtained by Dr. Hume in studying the question. He also made reference to the fact that window glass shut off the ultra-violet rays and illustrated this by reproductions of skiagrams taken at Vienna of the bones of rhachitic children.

DR. HARVEY SUTTON, O.B.E., in discussing Professor Martin's address said that he had been interested particularly in its latter part. He made reference to observations that had been made some years previously in an open-air school in Victoria. The observations had extended over some years. The children had been drawn from an industrial suburb and had been pale and under-developed. They had all lived in over-crowded homes. The children who had gone home for the week ends, had been weighed

on Mondays and Fridays. It had been found that an increase in weight occurred which was very similar to that shown in the graphs from Dr. Hume's experiments. It had been noticeable, moreover, that though a rapid definite increase in weight occurred for the first six to eight weeks and slowly when the normal had been reached, there was, however, always a loss at the week ends. He had not realized the ultra-violet light was probably responsible for this.

DR. R. R. SAYERS (United States of America) expressed his keen appreciation of Professor Martin's address. His appreciation was manifested by the fact that he had taken notes throughout its course and it was a long time since he had done this. His interests lay chiefly in work underground and he was concerned more perhaps with atmospheric conditions and efficiency than with climate and efficiency. Many factors mentioned by Professor Martin were of importance underground. These were the atmospheric pressure, the quantity and composition of the atmosphere, the presence of particulate matter and movement of the air and its stimulating effect on the skin. Dr. Sayers referred to the value of the removal of heat from mines and the increased efficiency obtained as a result of the movement of air. He gave details of several experiments and concluded with reference to one in which with the establishment of movement in the air the output from the area concerned had been increased by nearly five times the original amount and the miners had felt better.

PROFESSOR SHOZO TODA (Japan) said that he had undertaken practical experiments in regard to high temperature and humidity with rats and mice in a specially constructed chamber. In the conditions of the experiment the temperature had been 38° C. (100° F.) and the humidity of the air had been 80% to 90% with little atmospheric movement. Young animals had died within a few days after an exposure of eight hours in each day to this atmosphere. The older animals had lived for a longer time than the younger ones. Animals dying after exposure to this atmosphere did so with symptoms of a severe nervous affection without the production of any particular pathological change in the organs. It had been found that if attention were paid to their food and drink, they could be kept alive much longer. Even very young animals, if carefully nursed, might grow up in a satisfactory manner. From these experiments he had drawn several conclusions in regard to dwelling rooms or industrial buildings in which a high temperature with high humidity might be present in the course of a hot summer. It was necessary in the first place to pay attention to the requirements of the occupants in regard to food and drink. Secondly attention should be paid to the wind velocity as compared with the wet bulb thermometer readings and thirdly the individuals concerned must have sufficient sleep during the night and sufficient rest at other times.

The Ventilation of Rooms.

PROFESSOR SHOZO TODA (Japan) read a paper entitled "The Natural Ventilation of Rooms of Various Construction: Experiments in Standarizing Labourers' Dwelling Houses." Professor Toda pointed out that the purity of the air in dwelling houses depended upon the cubic space for each individual and the facilities afforded for the entrance of fresh and the exit of four air, *id est* on the degree of natural ventilation. Natural ventilation depended upon the wind velocity of the air outside, upon chinks and apertures due to loose fittings of windows and doors and crevices in the walls. There were also to be considered thermal differences between the atmosphere inside and that outside the dwelling and the permeability of the walls. The wind velocity and the construction of windows were the two most important considerations. The natural vehtilation was found to be directly proportional to the velocity of the local wind. On this account it was necessary to pay attention to the location and surroundings of the house. The next consideration was the construction of windows. Three kinds of windows were used in Japan: French winows, English windows (sash windows sliding up and down) and Japanese windows (sliding horizontally). Professor Toda preferred sliding glass windows with *shoji* instead of curtains. *Shoji* was used to make paper screens and about thirty or forty varieties were on the market in Japan. *Shoji* papers permitted a moderate percolating action of the air with a good diffusibility of carbonic acid gas. Moreover, they had a lower thermal conductivity than glass and they reduced daylight by nearly 50%. It was a frequent custom to make use of a pair of *shojis* on a window sill parallel to and inside a pair of glass windows. He had proved that *shoji* was a good safety valve in the event of overcrowding in the dwellings of poor people. In conclusion Professor Toda referred to experiments which he had carried out in regard to ten model dwelling rooms of various materials constructed for that purpose. He showed his findings in an extensive table. The indications were that Japanese rooms when loosely built were the most satisfactory. The objects of the experiments was to ascertain the most economical type of room and the most hygienic in construction to suit the climatic variation in central Japan.

Climate, Weather and Metabolism.

DR. C. E. CORLETTE read a paper entitled "On Some Relations of Climate and Weather to Metabolism." He said that the greater part of the paper which he proposed to read, had been published in THE MEDICAL JOURNAL OF AUSTRALIA of February 17, 1923. In discussing the table in his article which had reference to heat losses in respiration per cubic metre measured as expired, Dr. Corlette said that with the aid of a computer it would be possible to amplify the table so as to present a complete reference table for all degrees of temperature and saturation up to 33° C.. With the aid of such a table it would be possible to make out in a few minutes what the potential calorie loss per second might be for any sample of wind. The table could also be used for calculating and comparing the capacity of ventilating systems provided the volume, temperature and the hygrometric condition of the incoming air were known.

The Energy Consumption of Australian Students.

DR. H. S. HALCRO WARDLAW read a paper entitled "The Energy Consumption of Australian Students." This paper was published in THE MEDICAL JOURNAL OF AUSTRALIA on September 9, 1922. In his concluding remarks Dr. Wardlaw said that no figures were yet available for the basal metabolism of Australians. The experiments which he had reported, raised the question as to whether the Australian required less energy in his food for an occupation of a given degree of physical activity than a person of similar physique and occupation in a colder climate. With a similar basal metabolism the person in the warmer climate should require less energy for the performance of the same amount of physical work. He held that an investigation of the basal metabolism of Australians was therefore necessary to give information as to the actual food requirements of different members of the community.

PROFESSOR H. PRIESTLEY referred to Dr. Wardlaw's paper. He had recently carried out some experiments on twenty students. The results confirmed those of Dr. Wardlaw as far as the nitrogen output was concerned. The nitrogen output in the urine for twenty-four hours had averaged 11.2 grammes and the daily average output of urine 1,170 cubic centimetres.

Work and Hot Climate.

PROFESSOR C. J. MARTIN, F.R.S., read a paper entitled "Muscular Work and Hot Climates." He said that the observations to which he would refer, were nearly ten years old, but had not been published. At the time the work was done the question of tropical colonization had been of burning importance. He had been unable to find accurate data as to how much work a man could do under different conditions as regards temperature, humidity and wind velocity. This knowledge had to be made. The observations had been made upon himself. The problem which he had set himself to find out, had been the limiting conditions of temperature and humidity under which a man could work at one-tenth horse power. He had chosen

this unit as a result of his inquiries from engineers as to the amount of work that a navvy did in a shift. The replies had led him to conclude that this was a fair average of the rate of work performed.

Professor Martin described in some detail the construction of the room in which this work had been carried out. The walls had been double as had been the windows. An electrically heated coil had been placed between the two layers of glass windows; the floors had been covered with felt and an apparatus had been installed for the blowing of steam into the room. The temperature of the room had been controlled by hot water pipes and electric radiators. In this way it had been possible to obtain any wet or dry bulb temperature in the room that might be desired. In order that the air might be stirred up, a couple of fans had been placed on the floor. A fan had been placed so that it played on to his chest, producing an air current of sixty-three metres a minute. It was important to note that he had not been working in a stream of moving air such as was present in a mine, but in moderately still air with a current of air playing on a limited area of his body. A definite amount of work, one-tenth horse power had been performed upon a bicycle ergometer during three hour periods. A simple type of ergometer with an error of only 2% had been constructed. It had been a machine of the brake type, a heavy iron wheel having been substituted for the back wheel of a bicycle. It had been so constructed that the experimenter working the machine would be able to make all the necessary observations. The friction had been made by means of an ordinary bandage hemmed at the edges. This did not get heated. The friction pull had thus been steady and nearly independent of the velocity. In this way it had not been necessary always to pedal at a constant rate. It had been possible to adjust the instrument for any rate of work at any pedal revolution desired. The ends of the bandages had been attached to whipcord and so to two balances after passing over ball-bearing pulleys. The pull made was seen in a difference in the balances. He had set the instrument so that with a pedal revolution of one per second the work done equalled one-tenth horse power. Professor Martin pointed out that there was only a small range of body temperature within which the body could perform work with efficiency. With the commencement of work the rectal temperature steadily rose and equilibrium was maintained at 38.4° C. (101° F.) or 38.9° C. (102° F.) according to the circumstances. This was a well-known phenomenon. He recalled the incident which had happened on playing racquets with a colleague in hot weather in Egypt when the dry bulb temperature had been 36.2° C. (97° F.) and the wet bulb reading had been 21° C. (70° F.). The colleague's rectal temperature at the commencement of the game had been 37.8° C. (100° F.). After playing for quite a short time the colleague had been compelled to stop playing and had been surprised to find that his rectal temperature was 39.7° C. (103.5° F.). On cessation of work his temperature had returned to normal within an hour. It had been common belief that the temperature of an individual engaged in mountain climbing went down. This was, of course, because the temperatures had been taken in the mouth and not in the rectum. Professor Martin recalled an experiment which he had made and showed the chart on the screen. He had climbed a hill one hundred and twenty metres (four hundred feet) in height in half an hour with an overcoat on. Before making the ascent his mouth temperature had been 36.7° C. (98° F.) and his rectal temperature 37.6° C. (99.5° F.). On reaching the top of the hill he had been sweating. His mouth temperature had been 35.6° C. (96° F.) and his rectal temperature had been 38.9° C. (102° F.). Balance had been resumed after about an hour. He had carried out many similar experiments on himself and had found that the body temperature rose soon after commencing work in cool weather. He showed on the screen charts obtained when working at one-tenth horse power under various atmospheric conditions. After a short interval of time an equilibrium had been reached at which the temperature remained at about 37.8° C. (100° F.), 38.4° C. (101° F.) or 38.9° C. (102° F.) according to the wet bulb temperature of the room. In experimenting on himself he had found that with a wet bulb temperature of 30.5° C. (87° F.) and a dry bulb reading of 34° C. (93° F) he had reached an equilibrium at a temperature of 38.6° C. (101.5° F.). After three hours he had got tired and had been unable to go on as his temperature started to rise. When working with a dry bulb temperature of 36.7° C. (98° F.) and a wet bulb temperature of 31° C. (88° F.) he had found it necessary to stop after an hour for he had suffered acute distress, his respirations had numbered forty-eight in the minute and his rectal temperature had been 39.4° C. (103° F.). He had been threatened with heat stroke. It was extraordinary with what rapidity the symptoms of heat stroke appeared. For himself with an air movement of sixty-one metres (two hundred feet) per minute over a part of the body and working at one-tenth horse power the limit appeared to be a wet bulb temperature of 30.5° C. (87° F.). All the experiments had been carried out with the minimum of clothing. He had endeavoured to test the truth of the conclusion of Boycott and Haldane that the only thing that mattered was the wet bulb temperature. These authors had found that with a wet bulb temperature of 31° C. (88° F.) without a fan and doing no work the conditions were too much for them and the rectal temperature steadily rose. He had carried out many experiments working at the rate of one-tenth horse power in which the wet bulb temperature remained the same, *id est* 28.3° C. (83° F.), but with variations in the dry bulb temperature of from 30° C. (86° F.) to 38.4° C. (101° F.). The results had been similar. It had occurred to him that a more convenient way might be devised for determining the truth of the statement that the wet bulb reading alone controlled the loss of heat. He had made an instrument which he had called the "homunculus." This was a cylindrical shaving soap tin made of copper alloy. It contained water or kerosene. It was fitted with a cork through which passed a thermometer. The bulb of the thermometer was surrounded by a spiral of "Eureka" wire of five ohms resistance. The cylinder was surrounded by butter muslin kept moistened by a suitable contrivance. The contents were stirred by a small current of air at a uniform pressure. The temperature inside the vessel was always constant at 37.8° C. (100° F.). The amount of energy required to maintain the internal temperature at 37.8° C. (100° F.) was proportional to the square of the voltage of the current passing through the coil. Observations of the voltage required to maintain a constant temperature had been made in a room with various dry bulb temperatures, but with the same wet bulb temperature and a constant air movement. These supported the conclusions of Boycott and Haldane.

TABLE I.

EXPERIMENTS WITH THE HOMUNCULUS ON THE LOSS OF HEAT.

Dry Bulb Temperature.	Wet Bulb Temperature.	Calories Lost per Minute.	Wind Velocity.
39.4° C.	29.4° C.	70.8 71.2	198 metres
35° C.	29.4° C.	72.6	
32.2° C.	29.4° C.	70.3 72.5	
36.2° C.	25.9° C.	96.1	210 metres
29.2° C.	25.9° C.	94.4	
36.2° C.	25.9° C.	84.9	120 metres
29.2° C.	25.9° C.	83.6	
36.2° C.	25.9° C.	74.5	72 metres
29.2° C.	25.9° C.	76.0	
35.8° C.	23.6° C.	103.0	
27.2° C.	23.6° C.	102.5	135 metres

Professor Martin concluded that the loss of heat from the body depended on the wet bulb thermometer temperature and the velocity of the wind in which the body was situated and in the case of a sweating body varied with that velocity in something approaching the cube root of it. The slightest clothing greatly diminished loss of heat. The atmosphere in contact with the skin covered became nearly saturated and the wet bulb temperature became raised. The other factor, movement of air, was reduced to a minimum. In all the experiments on himself he had worn merely a short pair of running trousers of light texture. These had soon become saturated with sweat. On one occasion when working at the rate of one-tenth horse power he had put on a pair of flannel trousers fastened firmly at the waist such as those worn for tennis playing. The wet bulb temperature had been 29.3° C. (85° F.). He had been in equilibrium at the time with a rectal temperature of 38.6° (101.4° F.), but had promptly developed heat stroke. After thus putting half of his body out of action he had converted it into an area from which he could lose little or no heat. The dictation of vanity in respect to clothing was a serious handicap to working efficiently in trpical climates.

DR. ELLSWORTH HUNTINGTON (United States of America) said that he had been much interested in the discussion on a problem which they were all trying to solve. When he got among physiologists he found them talking of cases and experiments. The geographers talked in terms of statistics and masses of people. It reminded him of an incident in which he had tried to obtain an expression of opinion from two men on a book in which the author had dealt with a subject from the geological and the mathematical points of view. One man, a geologist, had said that the geology was sound, but he did not think much of the mathematical method of presentation. The mathematician had said that the mathematics were quite good, but that he did not see any possibility of good being obtained from the geological aspect. It was so with many of the scientific problems. Most men saw only their own points of view. He wished to refer to some investigations that had been carried out in America. The National Research Council had established a committee to investigate the atmosphere in its relation to human beings. Coordinated work was being carried on by this committee. He also referred to the work that was being carried on by the Bureau of Mines in conjunction with the Government Public Health Service and a society of manufacturers in Pittsburg. Many useful results had been obtained by this cooperation and he had been impressed with the close approximation their figures had shown to those presented by Professor Martin. He thought that with more such investigations on individuals at rest and at work it would not be long before complete charts of persons at work in atmospheres of different temperatures and humidities would be drawn up. Dr. Huntington referred at some length to the method of obtaining information by the use of the partial correlation coefficient. This had been tried for ten weeks during which the influenza epidemic of 1918 was at its worst. The method was extremely useful. If a number of variables was available and it was desired to obtain information about the effect of any one of them on efficiency, the remainder of the variables could be held constant and a particular study applied to the one variable. He said that this principle had been applied to the many factors concerned in the influenza epidemic and that a relationship had been established between the high temperatures prevailing just before the worst phase of the epidemic and the death rate. An investigation of the relative humidity of the atmosphere had not established a strong enough relationship. The absolute humidity, however, had been sufficiently strongly related to be regarded as a factor. The moist air had been worse for the epidemic. He threw out the suggestion that the condition of the weather strengthened or weakened people. When the epidemic had been at its height, it had apparently overruled everything. Later on a fall in the temperature had had the effect of checking the force of the epidemic. In a comparison of thirty-six capital cities in regard to influenza most other apparent factors had disappeared on the introduction of the climatic factor. The climatic factor alone had stood in basal relationship to the epidemic in thirty-six cities.

An analysis had been made of the deaths in New York in regard to the different elements in the weather. There had been a relationship between the death rate, the temperature and the humidity. Each investigation had shown that the change in temperature had produced an effect. People indoors were influenced by the changes in temperature out of doors. With a rise in temperature during the epidemic the death rate had gone up and with a drop in temperature the death rate had tended to diminish. The change in rate had not lasted for long, but after a short interval an equilibrium had been established. Statistical and geographical studies might discover much, but it would have to be brought to the physiologists for explanation and elaboration.

DR. R. R. SAYERS (United States of America) said that he had carried out some investigations in the question under discussion. He referred to Haldane's statement in regard to the wet bulb thermometer. Haldane had not stated what the other factor concerned was. Dr. Sayers pointed out that an atmosphere with a temperature of 18° C. (64.5° F.) and a humidity of 100% produced the same effect as regards comfort as an atmosphere with a wet bulb temperature of 12.7° C. (55° F.) and a dry bulb temperature of about 26.6° C. (80° F.). He also referred to the pulse as a good indicator of the effect of an atmosphere. He had seen instances of heat stroke both in mines and in rooms in which the body temperatures of the persons affected rose to 38.9° C. (102° F.) and 39.4° C. (103° F.). He had seen a man exposed to a temperature of 37.8° C. (100° F.) for an hour, whose pulse-rate had risen to 175 and whose rectal temperature had been 39.9° C. (103.8° F.).

DR. HARVEY SUTTON, O.B.E., said that he had carried out some experiments of a similar nature to those under discussion some years previously. He had remained resting for two or three hours in a temperature of 35° C. (95° F.) with a humidity of 100% after fasting for seventeen hours. His rectal temperature had gone up to 39.9° C. (103.8° F.). At first he had become very sleepy and had experienced great difficulty in keeping awake. This had presumably been because his body metabolism was at its very lowest level. Later he had become irritable. His pulse-rate and respiratory rate had increased. He admitted that it was difficult for an observer to count his own respiratory rate, but held that it could be done. With the rising temperature the respiratory quotient got to a figure of unity. This was probably an indication that the carbo-hydrates were being utilized and would indicate that there was a chemical defence as well as a physical defence. He had often wondered why people in different latitudes were in the habit of eating certain articles of food apart from the question of procurability. He instanced the eating of rice in the tropics. It was possible that the carbo-hydrates were a defence against high temperatures.

DR. J. H. L. CUMPSTON doubted the wisdom of applying to large numbers of persons the results of fifteen minutes' exposure in specially constructed chambers. He had recently discussed the question with a man who had lived for forty years in Townsville. This man had said that there was no necessity to discuss the matter, but that it would be well for scientists to go to Townsville and do some manual work there. There was something in the suggestion. He had been interested in the method of partial correlation coefficients employed by Dr. Huntington in determining the factors concerned in the influenza mortality. He had also been puzzled by the sanctity claimed by mathematicians for their results. It was not proper to make fine deductions from statistics, for it was notorious that death certificates were unreliable to a very large extent. The deductions indicated by Dr. Huntington were quite at variance with Farr's law and did not at all explain why no epidemic had taken place for ten years and then a sudden explosion had occurred. Nor did they explain why in New York the epidemic had been not only prevalent but fatal in the winter and New Zealand in the summer. Dr. Cumpston referred to the figures obtained from an Australian troopship returning after the war. Influenza had broken out on board and the number of infections had been known. Clean cut statistical material

had been available. The facts had been sent to London to Dr. Brownlee. In the report obtained later Dr. Brownlee had made deductions of a three-phase cycle occurring in seventy cases on one ship in a period of ten days. The results might be mathematically unassailable, but Dr. Cumpston thought that the mathematician in such a case went further than he was justified in doing.

DR. HUNTINGTON stated later that he had not meant to regard climate and weather conditions as causative factors of influenza, but as factors determining the severity of the epidemic.

The Distribution of Insects Capable of Carrying Disease in Eastern Australia.

DR. EUSTACE FERGUSON read a paper entitled "The Distribution of Insects Capable of Carrying Disease in Eastern Australia." He said that it was important to discuss not only the insects which acted as intermediate or definite hosts of causal organisms, but also those which were potential carriers. Dr. Ferguson discussed the *Diptera* or two-winged flies under the headings of blood sucking and non-blood sucking forms. Of the blood sucking *Diptera* the mosquitoes were of the greatest importance. Six varieties of anopheline mosquitoes had been described in Australia. Four of these were of such local distribution or comparative rarity as to be negligible as carriers of malaria. The two varieties of most importance as carriers of malaria were *Anopheles annulipes*, Walker, and *Anopheles bancrofti*, Giles. The range of *Anopheles annulipes*, Walker, extended from Tasmania to the northern limits of Australia and beyond into the Papuan Islands and the Solomons. *Anopheles bancrofti*, Giles, had a more restricted range which extended from the Northern Territory to the south of Queensland. Its presence had not been recorded in New South Wales. No experimental evidence had as yet been brought forward to show that either of these varieties were vectors of malaria in Australia, but there could be no doubt that *Anopheles annulipes* was mainly if not solely responsible for the conveyance of malaria. The occurrence of six isolated instances of malaria in southern States in districts in which *Anopheles annulipes* alone was found, was in support of this contention. Dr. Ferguson traced the range of anopheline mosquitoes in New Guinea, Solomon Islands and the New Hebrides. *Aedes* (*Stegomyia*) *argenteus* (*Stegomyia fasciata*) was important as the vector of both yellow fever and dengue fever. The former disease had not yet been introduced into Australia, but severe epidemics of dengue fever had occurred. *Aedes argenteus* had been found in the whole coastal belt from Port Darwin throughout the Queensland coast as far south as Newcastle in New South Wales. Dr. Ferguson pointed out that it had been stated in Byam and Archibald's text-book that this mosquito was found in the southern portions of Victoria and South Australia. This was quite incorrect. Of the mosquito hosts of filaria *Culex fatigans*, the common house mosquito of tropical and sub-tropical zones, was probably the vector of filariasis in Australia. It was universally present in settled districts of Australia. Although these mosquitoes occurred in many of the Pacific Island groups, they were not the common vectors of filaria in Fiji, Samoa and the Ellice Groups. In these groups the vector had been proved to be *Aedes* (*Stegomyia*) *variegatus*, better known as *Stegomyia pseudo-scutellaris*. Dr. Ferguson described the distribution of this mosquito in the islands of the Pacific and said that it had not yet been reported as occurring on the mainland of Australia. In places where it occurred, the filariasis was non-periodic and there were some characteristic differences in the pathology of the disease that rendered it by no means certain that the parasites of nocturnal and non-periodic filariasis were identical. He also enumerated the varieties of mosquito in which complete or partial filarial development had been stated to occur.

He discussed the *Tabanidæ* or march flies of which two hundred and thirty species had been described in Australia. They were of interest as being potential carriers. An outbreak of anthrax had been put down to them in New Zealand some years previously and they were of importance on account of the possible rôle they played as vectors of *Onchocerca gibsoni*, the causal agent of worm nodules in cattle. The non-blood sucking flies including the blowflies were described in some detail, as were also the bot flies.

In reference to fleas Dr. Ferguson confined his remarks very largely to *Xenopsylla cheopis*, the vector of plague to man. It was the dominant flea all over the northern portions of the continent. In Sydney about 47% of the fleas found on rats belonged to this species. The percentage got higher further north in Queensland. In the southern States the records in regard to this flea were unsatisfactory. It was absent from Tasmania, but had been reported as occurring in Perth. *Ceratophyllus fasciatus* formed 17.7% and *Ctenopsylla musculi* 34.4% of the rat flea population in Sydney, but were practically absent from rats in Queensland. The three forms of lice infesting man were present in Australia. None of the lice-borne diseases such as typhus, trench fever or relapsing fever had been permanently introduced into Australia. The habits of the Australian would, moreover, operate in preventing the spread of these diseases if introduced. Dr. Ferguson added a note to his paper in reference to ticks. He described the varieties which were important from an economic standpoint, and said that *Ixodes holocyclus* by preventing the establishment of the fox had been the means of conserving a remnant of ground marsupials. He had cited this instance to show how certain pests, undoubtedly to be classed as noxious, might from this very property exercise a beneficial effect on other and more serious pests. He referred to what he termed the yeoman service rendered by the Australian Institute of Tropical Medicine at Townsville in extending the knowledge of noxious insects in Northern Australia and concluded with an appeal to medical practitioners and others to assist in the elucidation of the problem by submitting specimens to recognized authorities.

Insect-borne Diseases on the Australian Pacific Coast.

DR. R. DICK read a paper entitled "The Incidence of Certain Insect-borne Diseases on the Pacific Coast of Australia and Their Relation to the Prevalence and Distribution of the Insects Concerned." In his opening remarks Dr. Dick said that the insects concerned in the transmission of disease to man were limited to flies, fleas and mosquitoes. He proposed to deal with the subject under the headings of the various diseases caused. In regard to plague Dr. Dick discussed the various epidemics that had occurred in Australia, and said that it was the experience in Australia that plague in man was always preceded by plague in rats. He pointed out that this had not always been capable of definite proof. He quoted instances in which patients had been affected, and plague bacilli had not been recovered from the carcases of rats found in places frequented by the patients. He thought that the use of guinea pig as *éclaireurs* or the application of the precipitin test with the organs of these rats might have been helpful in determining whether they had died of plague. The use of this test had been suggested by Pulgher. It had recently been brought into use in this connexion in Sydney. Dr. Dick discussed the incidence of plague in relation to the distribution of *Xenopsylla cheopis*. Its distribution had determined the incidence of plague in Australia. Cragg had pointed out that unequal distribution of plague in India was due to the presence or absence of *Xenopsylla cheopis* and Hirst, while agreeing with Cragg, had said that the appearance of this flea on rats in localities where it was not indigenous, was to be regarded as a danger signal.

Malaria in Australia was generally regarded as a disease confined to the tropical regions of the continent. It had been made notifiable in 1915 in several of the States, but the returns furnished had not represented very precise information on the subject. The average number of deaths from malaria in the previous ten years had been thirty-two. It was probable that only a small percentage of these cases could be ascribed to locally acquired infection. That

it might occur locally had been demonstrated by the severe epidemic which had prevailed at Kidston, Queensland, in 1910. In New South Wales during the previous ten years five instances of locally contracted malaria had been reported. These had occurred in widely separated districts in no way related to one another and in each instance the district had been one in which the *Anopheles annulipes* species was known to exist. So far it had not been definitely proved that *Anopheles annulipes* was the vector of malaria in Australia, but the circumstances seemed to support the contention that it was the most probable intermediary.

Dengue fever occurred in the northern parts of the continent and as far south as latitude thirty. The culicine mosquitoes had been proved by Cleland, Bradley, Macdonald and others to be the conveyers of dengue and filariasis. Filariasis in various forms was prevalent in parts of Queensland and in the Pacific Islands. Of 1,200 patients admitted to the Brisbane General Hospital for all sorts of complaints 10% had harboured filariæ in the blood. In Townsville 3.4% of similar patients had harboured the parasite. There were many factors which influenced the spread of the disease, and in this connexion it was interesting to note the conclusions of Francis. He had stated that the filariæ did not multiply in the mosquito, that only a small number of filariæ were taken up by the insect when biting and that a still smaller number reached the proboscis. He had also pointed out that the filaria was not injected into the blood stream by the mosquito, but deposited on the skin which the larva had to penetrate in order to find its way to the nearest lymph gland. Moreover, multiplication of the filaria took place in the lymph glands of man and had to be deferred till a male and female found lodgement within the same gland and there grew and developed their genital organs preparatory to bringing about a fecundated adult female parent worm permanently located in that lymph gland. Dr. Dick said that these considerations together with the fact that a period of seventeen to twenty-one days was required to complete the development of the micro-filariæ in the mosquito militated against the successful carrying out of the cycle.

In regard to typhoid fever and allied diseases Dr. Dick said that a definite reduction in their incidence had occurred during the last twenty years. He reviewed briefly some aspects of the morbidity and mortality statistics and said that the rôle of the fly in the spread of typhoid fever had received a good deal of attention in many parts of the world. He referred to the opinion expressed by Bradley that transmission of infection by flies was possible, but that certain experiments seemed to show that such transmission was not so easy as might at first sight appear. A committee appointed by the Commonwealth Government in 1916 to inquire into the prevalence of typhoid fever in the States of Australia had concluded that, while the possibility that flies might act as vehicles of infection must be regarded as demonstrated, yet the most reliable authorities were regarded that there was not sufficient evidence to prove conclusively that flies played an important part in the spread of the disease in Australia. Dr. Dick said that experiences during the late war had furnished very strong evidence that flies played an important rôle in the spread of typhoid fever and allied diseases. Moreover, those concerned in the health administration of New South Wales were convinced that flies were one of the principal means of spread of this group of diseases. Water-borne epidemics had not occurred in the State and, while epidemics might occur from contamination of food by carriers, personal contact and fly-borne infection were the usual methods of spread of the disease. Dr. Dick referred to the successful results that had attended the use of preventive inoculation in certain instances. In discussing dysentery he pointed out that the disease was notifiable in Queensland, Victoria and Western Australia and that deaths under the heading of dysentery figured in the statistics of the States and Commonwealth. As the term was loosely applied to many forms of diarrhœa, any conclusions based on the figures would serve no useful purpose. Beare had drawn attention to the importance of flies as vectors on infection in dysentery.

PROFESSOR C. J. MARTIN, F.R.S., said that he had been interested to hear both Dr. Ferguson and Dr. Dick refer to the fact that no exacerbation of malaria had occurred on the return of infected troops from the war. Such an exacerbation had taken place in England and it had involved regions in which it had occurred in olden days. The increase had been only a small one and had soon disappeared. He wished to ask Dr. Ferguson whether *Xenopsylla astia* occurred in Australia. It had been a problem in India as to why Madras which abounded with fleas and had been the site of the introduction of plague, had nevertheless remained free of plague. When he was working in Bombay, they had found it necessary to import rats from Madras, as so many rats in Bombay were immune to plague. The reason had been discovered later on. *Xenopsylla astia* had been found in Madras as the prevailing variety of flea. It was not a carrier of plague and very difficult to distinguish from *Xenopsylla cheopis*. A translucent light was required before the two varieties could be distinguished. There was probably some biological reason why *Xenopsylla astia* was not a carrier.

DR. G. A. K. MARSHALL, F.R.S. (Great Britain), referred to an investigation made by Stanton as a result of a request of the Indian Government into the question of *Stegomyia* and ships. Stanton had found that *Stegomyia* mosquitoes could not be discovered on board ship unless the ship was moored alongside land. In regard to the non-occurrence of malaria in Australia Dr. Marshall thought that one of the main factors was the absence of a large native population.

DR. W. C. SWEET said that he was interested in malaria and filariasis. The Australian Hookworm Campaign was making a survey of these two diseases. It was complete along the north coast of New South Wales and as far north as Townsville. Malaria had been found at Palm Islands, but none had been found south of this point. They had not reached Cairns. No filaria had been found in New South Wales. In Brisbane 6% of those examined had been infected, none had been found at Maryborough. At Rockhampton 10% and at Townsville 6% of those examined had been infected.

DR. BURTON BRADLEY said that he wished to refer to his view in regard to the spread of typhoid fever mentioned by Dr. Dick. He held that the spread of typhoid fever was due to a fly-food chain. The fly was one part of the chain and the food was the other part. It was difficult to prove the existence of this fly-food chain on account of the long incubation period of the disease.

PROFESSOR MARTIN said that he was glad to hear Dr. Bradley explain his views, for he held that the transmission of such diseases by flies outweighed all other methods of transmission put together.

DR. EUSTACE FFRGUSON in reply to Professor Martin said that he had not found *Xenopsylla astia*, though he had been looking for it.

Insect-conveyed Diseases.

PROFESSOR J. BURTON CLELAND forwarded a paper entitled "Some Insect-conveyed Diseases of Man in Australia." He grouped the diseases into three categories, firstly those diseases in which the pathogenic agent was merely mechanically conveyed, secondly those in which the causative organisms multiplied in the intermediate host and thirdly those diseases in which it was probable or possible that the parasite passed through a phase of development in the vector. In the first category he included typhoid fever, bacillary dysentery and acute polio-myelitis and acute encephalo-myelitis. In the second category he included plague and the typhus-like disease described by Dr. F. S. Hone which he termed Hone's disease. In regard to the latter disease he said that it was reasonably certain that the virus was conveyed by insects or arachnids, although so far observations had not revealed any probable vector. It was possible that infective granuloma of the pudenda might be included in this category. In the third category Professor Cleland included malaria, dengue fever and filariasis.

The Stegomyia Problem.

DR. BURTON BRADLEY outlined the work undertaken by himself and Cleland in 1916 and 1917 while inquiring into the nature of the virus of dengue fever and the method of the transmission of the disease in Australia. He outlined the characteristics of the disease as occurring in Queensland and the northern portion of New South Wales. He referred particularly to the variability or even the absence of the rash and the moderately frequent occurrence of slight jaundice and enlargement of the lymphatic glands. Relative or absolute bradycardia was also met with, while intense eye pains, body pains and great mental depression were common symptoms. He reviewed the experiments made by Cleland and himself with *Stegomyia fasciata* collected in Mullumbimbi. These mosquitoes had bitten a patient suffering from dengue fever on the second day of the disease. The experiments had been carried out in Sydney, a place that was free from dengue fever. Typical infections had been produced in four individuals bitten by these mosquitoes and the blood of these persons had reproduced the disease on inoculation. No infections had been produced by the bites of *Culex fatigans* which had bitten the patient suffering from dengue fever. Dr. Bradley referred to what he termed the obvious fallacies in the work of Graham and also of Ashburn and Craig which were frequently quoted as proving the effectiveness of *Culex fatigans* as a possible vector. He also outlined the results of numerous inoculation experiments made in Sydney in regard to the filtrability of the virus and others indicating the period of infectiveness of the blood of the patient—the period of survival outside the body under varying conditions. He finally urged the need for further work on a disease which, though itself mild, presented many close analogies to yellow fever.

DR. EUSTACE FERGUSON said that he had had no personal experience of dengue fever. He referred to the work of Graham who had carried out his experiments on the Lebanons because they were free from *Stegomyia* mosquitoes. Dr. Ferguson recalled an occasion when he had caught a *Stegomyia fasciata* on his hand while on the range of hills further inland than the Lebanons. He held that if these mosquitoes were found on the range of hills next to the Lebanons, they would certainly be present on the Lebanons.

PROFESSOR H. PRIESTLEY confirmed Dr. Bradley's statement in regard to the variable nature of the rash in dengue fever. It might be absent or it might assume the form of a scarlatiniform rash or be characterized by plaques as large as a penny. The pain in the eyeballs was most characteristic. In regard to Dr. Bradley's work it was not certain that he had excluded the possibility of other mosquitoes being concerned in the transmission of dengue fever. Dr. Bradley had not claimed that he had done so. It was difficult to explain the sudden outbreak of an epidemic of dengue fever in view of the fact that the *Stegomyia fasciata* was always present. He wondered whether there was anything in the developmental aspect.

DR. J. S. ARMSTRONG (Samoa) said that Whittingham had reported an allied disease in the Mediterranean due to a spirochæte. He asked whether any work had been done on any allied disease.

PROFESSOR H. PRIESTLEY said that in scrub lands in Queensland there was a fever known as sand fly fever. It had a sudden onset and was quickly over. He had done no work on this, but had investigated an allied disease, epidemic glandular fever, which was characterized by a rash in addition to enlarged lymphatic glands. He was convinced that this was transmitted by a mosquito, but he had been unable to transmit it to monkeys or to human beings. He suggested that it might be due to a spirochæte.

DR. BRADLEY in his reply discussed the point raised by Professor Priestley in regard to the outbreak of epidemics. He thought that it was no exaggeration to say that in a first epidemic everyone became infected. He had shown that an immunity was conferred, but had not shown that the immunity passed off. Granted that this was so, it was easy to see how a fresh epidemic might break out.

Destruction of Insects.

DR. J. S. PURDY, D.S.O., read a paper entitled "The Use of Petroleum in the Destruction of Insect Carriers of Disease." He confined his remarks mainly to the destruction of the mosquito and the flea. After reference to the manner in which mosquitoes had been banished from several localities in Egypt, he made reference to an innovation which he had seen in Manila for this purpose. In this place use had been made of bags of sawdust saturated with petroleum. He pointed out that the bags placed in stagnant water released slowly and continuously the oil from the sawdust. The surface of the water was thus kept covered with oil and the larvæ had no chance to breathe; consequently they died. In regard to fleas he claimed considerable success in ridding premises of fleas by using an emulsion of kerosene (eighty-two parts), liquid soap (fifteen parts) and water (three parts). The explanation of the wonderful and almost instantaneous effect of the slightest film of kerosene applied to an insect was the closing of the stomata or breathing spaces in the skin.

PROFESSOR SHOZO TODA (Japan) discussed the question of mosquito control with kerosene. He had made some experiments three years previously and had found that the action of petroleum in killing mosquitoes depended on the action of the volatile matters in petroleum with a low flashing point. The volatile oils had a special affinity for the respiratory membrane of the mosquito larvæ. This was chiefly of the nature of an anæsthetic action. It was neither an ordinary form of intoxication nor was it a simple suffocation. It was not necessary to cover the whole surface of the water to kill the larvæ and pupæ of mosquitoes in the water. He had shown the special affinity of petroleum for the respiratory membrane by means of a petroleum solution of Sudan III. With this it was very easy to stain the respiratory membrane of the larvæ. If a watery or alcoholic solution of Sudan III. or of fuchsin were used, the respiratory membrane would not stain at all. The same results had been obtained with some other insects.

PROFESSOR H. PRIESTLEY said that he was interested in the use of kerosene and Mexican oil. He had found as a result of his experiments in Townsville that kerosene acted on mosquito larvæ as a toxic agent. It killed the larvæ more quickly than the evacuation of air over the water by means of an air pump. He had found that cresylic acid was an effective insecticide.

DR. HARVEY SUTTON, O.B.E., after drawing attention to the lack of methods of dealing effectively with pediculosis, said that he had found the use of *liquor cresolis saponatus* very effective in killing fleas during the campaign in Palestine. He suggested that eucalyptus should be exploited as an insecticide. Australians had not yet learned to use it.

District Incidence of Disease.

DR. HARVEY SUTTON, O.B.E., read a paper entitled "District Incidence of Disease in New South Wales." He confined his remarks to three diseases: trachoma, hookworm and endemic goître. Trachoma was definitely associated with the western plains and especially the Darling River Basin where sand, heat and flies formed a part of the regular summer weather. The out-of-doors bush fly, *Musca vetustissima*, appeared to be the active agent in transmitting bacterial and trachoma infections. The house fly and to a minor extent the common towel assisted transmission in the household. Dr. Sutton held that the climatic factor decided the incidence and supplied the necessary background predisposing to the disease. The investigation in regard to hookworm had been undertaken by the Australian Hookworm Campaign. The endemic area in New South Wales extended from the Queensland border to the north along the coast to a point between Taree and Dungog. The area extended inland for a distance of ninety-six kilometres (sixty miles). Of 8,602 white children 4.6% had been infected. A second survey had shown that 3.4% were infected. Black children were infected to a much higher degree. Of 116 black children 75% had been

infected. Dr. Sutton said that the figure of 4.6% in regard to white children was to be regarded with anxiety in view of the backwardness and invalidity which might result. In discussing epidemic goitre Dr. Sutton read portion of an article that was published in THE MEDICAL JOURNAL OF AUSTRALIA on March 10, 1923. He illustrated his remarks by means of a map published in the same issue of the journal.

Heredity and Cancer.

PROFESSOR H. GIDEON WELLS (Chicago, United States of America) forwarded a most interesting paper entitled "The Influence of Heredity Upon the Occurrence of Cancer." This paper was communicated by Professor F. P. Sandes. In his opening remarks Professor Wells said that until recently it had been impossible to speak with much assurance concerning heredity in cancer. In the year 1900 two unrelated discoveries had lead to an entirely new outlook on the subject. In that year three investigators independently of one another had rediscovered the fundamental principles of heredity that had been described so accurately by Gregor Mendel in 1866. In this same year Loeb in Chicago and Jensen in Copenhagen had demonstrated that sarcomata in rats and carcinomata in mice could be inoculated into animals of the same species. Investigators had since learned that information to be obtained from transplanted tumours was limited especially in regard to heredity, but these observations had placed cancer research for the first time on an experimental basis. Professor Wells divided the evidence concerning the influence of heredity into several groups. The evidence furnished by human pathology he divided into that obtained by statistical investigation and that obtained by reference to cancer families. Evidence obtained from animal experimentation he divided into that obtained from transplanted tumours and that obtained from the observation of spontaneous tumours. Statistical evidence might be dismissed with the statement that in the question of human cancer heredity all existing statistical evidence was valueless for any exact information on the subject and must remain so until such time as autopsy records were available in regard to all persons dying in the several generations. Of the existence of cancer families there could be no doubt. Unfortunately the records of many cancer families did not include records of the non-cancerous members of the family. There was also the defect that the records depended only on family traditions and belief as to the cause of death. In family records with a high incidence of cancer, no matter how high the proportion was, the possibility that the heaping up might depend on chance could not be evaded. Granted that about 10% of all people over forty years of age suffered from cancer, the laws of probability would determine the occurrence of occasional families in which a high proportion of cancer would occur if heredity had no influence at all. Likewise there were fortunate families that escaped through pure chance. Professor Wells gave a most interesting review of the work of many observers on family incidence of cancer; unfortunately this is much too lengthy to be included in a short résumé of his paper. He pointed out that family occurrence of such rare neoplasms as glioma of the retina, multiple neuro-fibromatosis and multiple cartilagenous exostoses could not be dismissed as depending on chance. He concluded that a definite susceptibility to cancer existed in certain families and family generations. In regard to animal experimentation Professor Wells pointed out that an inoculated tumour was something quite different from a spontaneous tumour and that relatively little could be learned from the disease cancer from such experiments. A transplanted tumour was never the growth of the cells of the inoculated animal, but was a growth of the cells of the animal that had furnished the original spontaneous tumour from which the transplanted growth had been obtained. The animal bearing an engrafted tumour was merely furnishing the soil on which some grafted tissue was growing. That the inoculated cancer was fundamentally different from the spontaneous cancer was shown by the fact that successfully inoculated growths often disappeared spontaneously and that protection might be furnished by various procedures of immunization, phenomena which were never seen in spontaneous tumours. Furthermore, animals which were immune to tumour inoculation, might develope spontaneous tumours and by painting tar on the skin true carcinomata might be produced in mice immune to grafts of the same sort of tumours. In addition transplanted carcinomata grew particularly well in young animals and not solely in animals of "cancer age." For these reasons observations on the influence of heredity upon the susceptibility of animals to transplanted tumours could have no direct bearing on the question of susceptibility to spontaneous tumours, since the resistance to one bore no direct relation to the resistance to the other. There were several things of interest, however, to be learned from the inoculated tumours in respect to heredity. Thus, close relationship of animals was favourable to inoculation; certain strains of animals were insusceptible to tumour grafts to which other strains of the same species were susceptible and heredity influenced in a constant manner the susceptibility of a given strain of animals to inoculation with cancer. In discussing the evidence from spontaneous animal tumours Dr. Wells said that, with the exception of the studies of Loeb and Lathrop and of Miss Slye, much of the evidence as to inheritance of a tendency to spontaneous tumour development in animals was of a somewhat casual nature. He referred to the work of Virchow, Ebert and Spude and Tyzzer. He also referred at some length to the work of Murray on the influence of heredity on spontaneous tumours by breeding from animals descended from cancerous females or by breeding from cancerous females with males descended from cancerous females and by breeding from the offspring of such matings. Murray had found a distinct liability to cancer of the mamma in mice descended from females so affected. Professor Wells quoted Murray's statement in this regard and said that the value of the study was limited by the fact that the ancestry of the mice was known for such a short period. There existed, however, a fundamental error in the method of selection employed by Murray. By selecting merely cancerous and non-cancerous individuals it was perfectly possible for some of the cancerous mice to have been members of strains or families in which the tumour rate was low, the cancerous individuals having been exceptional members of these strains. Equally well the non-cancerous individuals might have been exceptional members of strains or families in which the cancer rate was high. Loeb and Lathrop in 1918 had published the results of their investigations on the occurrence of subcutaneous tumours chiefly of the mammary gland in a strain of mice bred for commercial purposes by Miss Lathrop. Unfortunately all these tumours had not been examined microscopically and mice in which no tumours occurred, had not been submitted to systematic *post mortem* examination. The figures had been based solely on the presence of visible or palpable tumours and diagnosis had often been made only by observation of the gross appearances. Loeb and Lathrop had concluded that heredity was undoubtedly an important factor in determining the incidence of cancer, for they had established strains which included an almost constant proportion of animals with subcutaneous cancer through several generations. They had also found that a certain relationship existed between tumour frequency and tumour age. Professor Wells then referred to the extensive investigations undertaken by Miss Slye under the auspices of the Otho S. Sprague Memorial Institute, Chicago, with which he was connected. He explained that Miss Slye's work had been continued over twelve years and was the continuation of a study of genetics begun under the direction of Professor C. O. Whitman. The work had been carried out with a stock of mice of known ancestry for many generations. The mice had all been descendants of a limited and carefully selected stock bred according to definite plans designed to give evidence as to the influence of heredity upon the incidence of spontaneous tumours in mice. It therefore included strains of highly cancerous ancestry and strains with ancestry free from cancer. They had represented strains in which cancer was very common, strains in which it had not occurred and strains of intermediate character. None of the mice had been subjected to any artificial influences that might modify life. In no

case had a spontaneous tumour been used for inoculation or operated on and no mouse born in the laboratory had been used for any experimental work. Up to the time of making the communication over forty thousand mice had been examined *post mortem* and all lesions that might possibly be cancer or concerning which there had been any doubt whatever, had been examined microscopically by Miss Holmes or himself. All told at least five thousand spontaneous tumours had been observed in this stock. The majority of these had been malignant in nature. As all the mice had been submitted to necropsy Professor Wells concluded that the material had been adequate in amount and quality to furnish evidence against which the question of chance or inadequate control could not be raised. Professor Wells laid stress on the more prominent results of the investigation. In the first place it had been determined that cancer in mice appeared in most of the forms seen in man and in far greater variety than had previously been supposed. Mammary gland carcinoma had been the most common growth. The list of tumours found included primary tumours of the lung, primary liver tumours, sarcomata, tumours of the testicle, squamous carcinoma of the testicle or mouth, basal-celled carcinoma of the head, squamous-celled carcinomata of the stomach, ovarian tumours (mostly solid papillary adenomata), primary renal and adrenal tumours and uterine tumours half of which were leiomyomata. The abundant variety of tumours was held by Professor Wells to establish the identity of neoplasmic tumours of mice with tumours of man. The chief difference had lain in the distribution. In the second place it had been concluded that the tendency to become affected by cancer or the capacity to resist cancer was unquestionably influenced by heredity. Strains had been established in which among many hundreds of individuals through as long a period of observation as twenty-five to thirty generations not a single instance of tumour growth had been seen. Strains had also been established in which the occurrence of cancer was so common that it became the sole cause of death of the animals. Since cancer was a disease developing late in life, what was transmitted was the tendency or the resistance to the tendency, never the disease itself. The third conclusion formed from the observations had been that the resistance to cancer in these mice behaved in breeding like a typical Mendelian dominant character. When a cancer mouse derived from the crossing of mice with cancer, was crossed with a mouse free from cancer and derived from ancestors that had not shown cancer for many generations, the resulting hybrids of the first generation did not develope cancer. If one of these hybrids were mated with another or with a hybrid of similar ancestry, cancer would appear in the offspring in Mendelian proportions. Strains of pure cancer mice, strains of cancer resisting mice and heterozygous strains could be extracted exactly as with any other inheritable unit character. Fifthly it had been concluded that the behaviour of tumours was influenced by heredity. The localization of secondary tumours had been the determining factor of this observation. Professor Wells's sixth and last conclusion was that inbreeding of itself was not responsible for an increased susceptibility to cancer. It had been suggested that Slye's high cancer rates were the result of inbreeding. This statement was not warranted in the light of any appreciation of the principles of inheritance. Inbreeding merely concentrated existing characters, but did not produce new characters.

In discussing the mechanism of the hereditary influence Professor Wells said that in view of all the experimental evidence cited and in the absence of any evidence which contradicted it, the conclusion seemed inevitable that the incidence, character, location and behaviour of tumours depended to some extent at least upon the inherited qualities of the animal and of its tissues. The question as to the manner in which heredity determined susceptibility or resistance to tumour formation, might be answered by the statement that tumour formation was the result of stimulation of the tissues to growth, the stimuli being of various sorts and non-specific. Some stimuli produced definite proliferative effects in proportion to the retrogressive effects and such stimuli were particularly capable of leading to neoplastic proliferation. The same amount of stimulation did not produce equal amounts of proliferative reaction in all individuals even when of the same species. Hence there were individual variations in both amount and character of proliferative reaction to a common stimulus and these variations undoubtedly depended in part if not wholly on an hereditary basis. Evidently then heredity might determine whether the proliferative reaction that followed injury, assumed a neoplastic character or not. This had been pointed out especially in the study of the lung tumours in Slye's mice; mice with cancer heredity reacted to non-specific inflammatory conditions more often with excessive proliferation which led to malignancy than did mice of non-cancerous ancestry. Slye had found that the hereditary factor of resistance to cancer might become so high in pure strains of selected mice that no ordinary amount of proliferative stimulus could overcome it. Strains of cancer-resisting mice had been developed in which cancer had not appeared during at least thirty generations; this would correspond in human life to close upon a thousand years. Conversely the capacity to resist cancer might be so effectively removed that virtually ever mouse of a selected strain would develope malignant neoplasms from the ordinary proliferative stimuli occurring even under the best living conditions.

In regard to the relation of animal experiments to human disease Professor Wells said that several factors had to be considered. In the first place cancer in animals was in all essential respects the same disease as cancer in man. Secondly, the laws of heredity were fundamental biological laws applicable to every living thing, whether plant or animal. Mendel had worked out the principles of inheritance with garden peas and if they held good with peas and mice, they should hold good for man. In the third place Mendelian principles appeared in human inheritance. In hereditary hæmophilia and in colour blindness were found perfect illustrations of an inherited sex-linked recessive unit character. Conformation to the Mendelian principles was also seen in the separation into four groups of the human red blood corpuscles in respect to isoagglutination. If human cancer was a condition determined by a recessive unit character, then it should be expected that in the heterozygous human race breeding indiscriminately in respect to cancer ancestry the recessive character of tumour susceptibility might appear in almost any members of a given family group and ordinarily involve only a small proportion of the entire family. It might be expected that the offspring of two individuals with an inherited tendency to cancer which ordinarily would not manifest itself during the reproductive period, would inherit the cancer susceptibility. The demonstrated existence of "cancer families" agreed with this hypothesis. The more common occurrence of families without cancer corresponded equally well to the expectations of this hypothesis. When either but not both of two parents had cancer, it would not be necessary for the offspring to develope cancer, since the other parent might be resistant (and dominant) to cancer, even if he or she had cancerous relatives; the offspring might correspond to a first hybrid generation in which none of the members had cancer. If one parent had cancer and the other parent was heterozygous to cancer, as was usual in the family history of descendants of a single cancerous ancestor, the first generation should include some cancerous individuals (pure recessives) and some heterozygous offspring who did not have cancer themselves, but who might transmit the tendency to cancer. It was also perfectly possible for heterozygous and dominant resistant individuals to mate with one another for several generations without the recessive appearing, but when heterozygous offspring of such unions mated, individuals with cancer might appear. Professor Wells concluded that the considerations fitted well with what was known at the present time of human cancer. Until Miss Slye's conclusions were confirmed or refuted, it might be just to consider them as offering at least a reasonable explanation of the influence of heredity on human cancer.

Tropical Settlement.

THE subject of tropical settlement was discussed at a joint session of the Sections of Hygiene and Geography on

August 27, 1923. DR. ELLSWORTH HUNTINGTON (United States of America) occupied the chair.

DR. ELLSWORTH HUNTINGTON opened the discussion. He examined the comparison of death rates as a criterion of the effect of disease. The comparison of death rates might be a good method in some instances and it might be a bad method in others. He recalled that one occasion he had made three maps of Europe. One had been based on climate, a second had been based on statistics and a third had been based on degree of progress that had been made in the opinion of fifty persons. These maps had been very similar. Climate had an influence on health and activity. The use of death rates as a measure of health was justified in Europe on account of the fact that the population was stable. There had been some segregation, but not much. In Australia the condition of affairs was different. It was one of the newest countries. About 80% of the people were born in Australia. The parents had been born largely in Europe. In these circumstances it was possible to come to wrong conclusions. It was sometimes claimed as a result of the low death rate that the climate was remarkable. What sort of people came to Australia? There was a kind of natural selection going on. A man whose father and mother were feeble, would not be so likely to come to Australia. It took more energy to come to Australia from Europe than it did to go to some other places. There was also a certain financial selection. It cost more to come to Australia. In this process of selection the people were more energetic and healthy and free from organic disease with the possible exception of diseases of the lungs. The death rates of a selected people would be lower. They had a stock case in America. If consideration were given to the condition of things at Panama, it would be seen that a lot of sheer nonsense had been talked about it. There were very few women and very few children in Panama. Men who went there, were required to undergo a medical examination before doing so. In any case if they were sickly, they did not care about going there. It had been claimed that they had conquered tropical diseases in Panama. He did not for one moment wish to discredit the wonderful work that had been done in the prevention of disease in Panama, but it would be found that the death rate in Panama of men between twenty and forty years of age was higher than in the United States. He had been surprised to find the number of people in Australia who declared that it had the finest climate in the world. It seemed to be a patriotic duty of Australians not to say anything derogatory about their country. That did not do any good. People did not mind saying things about the blow fly in sheep. The same condition existed in America. No one held that the blow fly was a good thing to have in the country. Why not be equally candid and deal with the climate in the same way? Selection was in operation not only in regard to Australia, but in regard to Queensland as compared with the rest of Australia. Many of the same factors which he had previously mentioned, prevented some people from going to the northern parts. Dr. Huntington analysed the curves of the death rates for boys and girls in Denmark, in Victoria and in Queensland. He claimed that the variations in the death rate curves were the result of the selective process. If death rates were to be taken as a standard, they would have to be considered in periods of ages such as those from thirty to forty. The country would be in the lead that most carefully selected the persons going to live in it.

In his closing remarks Dr. Huntington paid a tribute to the work of the Australian Institute of Tropical Medicine at Townsville. It was an institution of which Australians could be proud.

Tropical Settlement in Java.

DR. C. A. BRAAK (Dutch East Indies) spoke on the subject of settlement in Java. He began by pointing out that conditions on the low lands and in the hill country were very different. He also laid stress on the necessity of adapting habits and clothes to the mode of life. There was not much variation in the temperature in the different seasons. On this account the climate was preferable for example to that of Calcutta and Port Darwin. In these places it became a little cooler in one season and a little hotter in another. It was the "little bit hotter" that made all the difference. The life of the Dutch in Java was one of mental and not of physical effort. The natives did the manual labour. This could not be compared with the condition existing in Queensland. In regard to the question of whether white people could stand the tropics, he was prepared to offer general suggestions only, as he was not a medical practitioner. Most of the bad things in connexion with tropical climates had been caused by disease. There were in his opinion not many people who could not become acclimatized. It was a fact that it was not so easy for a man to do his full duty in the tropics. Persons returning to Holland, after having lived for twenty years in Java, did not give any evidence of being inferior to those who had stayed at home.

Climatic Factors Determining Tropical Settlement.

PROFESSOR GRIFFITH TAYLOR read a paper entitled "Climatic Factors Determining Tropical Settlement." He said that there were about 180,000 people in the tropical parts of Australia. Of these about 171,000 were to be found in the State of Queensland. The best method of comparison of climates was by the means of "homoclimes." These were found by tabulating the average and the range of temperature and rainfall for a large number of places. In this way he showed that the climates of Calcutta and Townsville were similar. Other places with corresponding climates were Brisbane and Durban, Sydney and Willmington in North Carolina, Melbourne and Oporto, Launceston and Falmouth, Perth and Capetown, Wyndham and Tinnevelli. With wet bulb temperatures and relative humidity records of the twelve average monthly figures a twelve-sided polygon might be plotted. This was known as the climograph. By superimposing climographs it was possible at a single glance to determine homoclimes and suitability for white settlement. Professor Taylor said that he assumed that such a climate suited a white man best as had already attracted him to close settlement in other parts of the world. Thus he showed that in a composite graph constructed from twelve leading cities of the world populated by whites the graph for Sydney overlapped the common graph for quite half of its extent. The graph for Port Darwin did not approach the common graph either in position on the sheet or in shape. In comparing South Africa and Australia the differences in climate and habitability by whites was explained by the elevation of the former country. In comparing rainfall the seasonal incidence had to be considered. The wet bulb thermometer was the best single instrument for indicating the habitability of any region as regards climate. Professor Gregory had said that a wet bulb temperature of 25.5° C. (78° F.) was the limit above which continuous hard work became impracticable. Professor Taylor concluded that a large proportion of people would not live in localities of great discomfort till the point of saturation had been reached in more attractive regions.

Physiological Observations in Tropical Parts of Australia.

PROFESSOR H. PRIESTLEY read a paper entitled "Physiological Observations in Tropical Parts of Australia." He began by stating that the question of the settlement of northern Australia by white people was important to all nations with tropical possessions. It was likely that before long the diseases occurring in the tropics would be controllable and that it was necessary to know whether there were any other conditions which would militate against permanent white settlement, conditions which in themselves were harmful. In most tropical countries it was not possible to separate the effects of infection from the effects, if any, of climate itself, owing to the unhygienic conditions of the dense coloured population, the heavy infection with disease and the fact that the white man in these places lived a very artificial kind of life. In northern Australia these factors could be dissociated and in point of fact a

large experiment was at the present time being carried on in regard to the effects of a tropical climate on the white race uncomplicated by disease or other factors. The indigenous population was very small and scattered and with the exception of malaria tropical diseases were practically absent. It was of importance to determine whether climatic conditions could cause racial degeneration. Climatically the northern portion of Australia might be divided into two portions—the coastal belt and the interior. The former was characterized by high relative humidity and high wet bulb temperatures with moderately high dry bulb temperatures. In the interior there was a lower relative humidity, lower wet bulb temperatures, but higher dry bulb temperatures. He intended to confine his remarks to the coastal region for only in this portion had experimental investigations been carried out. Any great increase in the population would take place in the coastal area. Professor Priestley described the climate of several towns by comparing them with other well known places. From the point of view of comfort and possibly health the wet bulb temperatures were of considerable importance. Variations occurred in this regard during the different seasons in different places, but in more northerly places, such as Thursday Island, there was little seasonal variation. At this place the average July wet bulb temperature was 23.2° C. (73.8° F.) and the average wet bulb reading in January was 25.9° C. (78.7° F.). Wet bulb temperatures could not be considered apart from dry bulb readings and the movement of the air had to be taken into account. Little importance had so far been attached to air movement as far as climate was concerned. There was need for some method of correlating the wet and dry bulb readings. Hill's katathermometer supplied valuable data when the air was moving at a constant rate, but chanegable breezes made the readings variable and impossible to interpret. Professor Priestley thought it possible that there were factors other than dry and wet bulb temperature readings and air movement which had to do with comfort and well being in a given area. There was very meagre and little convincing evidence to support the view held by some investigators that sunlight in the tropics had a deleterious effect on health apart from the raising of temperatures. It had been claimed that residence in the tropics caused physical degeneration and that white children could not be successfully reared. The children of North Queensland were not pampered by native servants and lived an outdoor healthy and active life. They compared (even those of the second generation) very favourably in regard to height, weight and physique with the children of other parts of the world. There was a widespread belief that a tropical climate impoverished the blood. Breinl and he had examined the blood of 574 apparently healthy school children ranging from seven to fifteen years of age. Of these 305 had been boys and 269 girls. Nearly all had been born in North Queensland and the greater number had not been out of the district. They had found that the average erythrocyte count was 5,077,000 per cubic millimetre and that 65.7% of the counts lay between 4,500,000 and 5,500,000. The average hæmoglobin value had been 90.5%. The average leucocyte count had been 10,035 per cubic millimetre. Professor Priestley pointed out that the only abnormality had been a slight increase in the number of leucocytes. There had been no anæmia. The Arneth index (obtained by adding together the percentages of the neutrophile leucocytes with a single undivided nucleus and of those containing two nuclear portions connected by a single thread) had been increased to 74.5. Arneth had claimed an index of forty for normal Europeans. The true significance of the Arneth index was not known. The specific gravity of the blood of a number of normal adults had presented no variation from the normal level. Young, Breinl, Harris and Osborne had found a small but variable increase in blood solids after profuse sweating in Townsville. No abnormality had been discovered either in the blood pressure or rectal temperatures of persons at rest. Mild exercise had increased the rectal temperatures to a somewhat higher level than that prevailing in Europe. Professor Priestley also referred to the work done by Breinl in regard to the effect of high wet bulb temperature on the pulse-rate, rectal temperature, skin shirt temperature and blood pressure of labourers on the wharves in Townsville. The results of this investigation had been published in THE MEDICAL JOURNAL OF AUSTRALIA on September 3, 1921. He pointed out that Breinl had given no details as to the method of determining the pulse-rates and the interval elapsing after cessation of work before making the observation. No results differing materially from those obtainable during strenuous work in temperate climates had been obtained. Young, Breinl, Harris and Osborne in Townsville and Chapman and Wardlaw in Sydney had determined the average carbon dioxide content of alveolar air and had found an average of 4.99%. Haldane and Fitzgerald on the other hand had found an average of 5.59% in England in twenty-seven persons. Boycott and Haldane had found that external temperatures influenced the carbon dioxide of the alveolar air, a lower percentage being obtained in warm weather. Professor Priestley laid stress on the fact that it had not been properly appreciated that there were variations in the amount of food ingested and in the body metabolism. Young had found the total nitrogen content of the urine of twenty-five persons in Townsville to be 10.4 grammes in twenty-four hours. In Europe this had been estimated at fourteen to eighteen grammes. The nitrogen content of the urine of twenty students at Sydney University had averaged 11.2 grammes. Professor Priestley concluded that no striking observations had been made of alterations in the physiology of persons in the tropics which could be considered the result of climatic influences. Much obviously remained to be done before the question could be settled. The mortality in Queensland was low. It had to be remembered that the population was scattered and infection was not easily spread. The low infant mortality might be due in a large measure to the fact that most of the milk was boiled to prevent souring. Mortality figures did not help the investigation much.

In conclusion Professor Priestley said that he thought that there were some factors, possibly attributable to climatic influence, which might militate against permanent settlement in the north. He recognized that he was on dangerous ground and that his data were inadequate. He drew attention to the frequent occurrence of neurasthenia in tropical climates. Concentrated mental effort was more difficult and it was easier to become slack. There was considerable mental inertia. The discomfort from high temperature and high humidity were doubtless responsible for this. Professor Priestley referred to the unhappy lot of women folk in North Queensland. They were compelled to work without assistance in the high temperature of a kitchen. This was one of the great difficulties to be faced. He also saw in the universal discontent in the ranks of the working men an influence of climate on the central nervous system. In answer to the question as to whether it was possible to settle Northern Australia with a permanent white population, the verdict in his opinion would have to be "not proven."

DR. HARVEY SUTTON, O.B.E., said that at the 1920 Australasian Medical Congress it had been shown that Queensland stood high in regard to the human product from every conceivable point of view. He thought that the position of women in Queensland had been exaggerated. The fertility of women in Queensland was high. The statement about neurasthenia was heard everywhere. He held that it was not based on scientific data.

Physical Characters of the Australian Aboriginal.

DR. A. N. BURKITT read a paper before the Section of Anthropology and Ethnology on August 27, 1923, entitled "The Physical Characters of the Australian Aboriginal." In his opening remarks Dr. Burkitt acknowledge his indebtedness to Professors Wilson, Hunter and Wood Jones, Dr. Lightoller and Mr. Matthews for their help in his investigations. He said that the aboriginal skull was definitely dolico-cephalic or long headed, but a considerable percentage were also platy-cephalic or vertically flattened. Many students believed that these platy-cephalic skulls were more frequently found along the southern parts of Australia and adduced their presence as evidence of an admixture of a lower race with the typical Australian

aboriginal. A low forehead with prominent supra-orbital tori was another feature more often seen in the male. The temporal region looked at from above was frequently seen to be flattened, but it was not yet clear to what extent this was a constant feature. Dr. Burkitt emphasized the value of the work of Berry and his colleagues in regard to measuring the skull and said that it was necessary to be constantly on the watch to determine whether the right things were being measured. He thought that the ideal would probably be attained when the factors concerned in shaping the skull were dissected out as Mendelian characters. When these characters had been discovered, the statistical method as emphasized by Berry would have to be applied. Turning to the facial characteristics of the skull he said that he believed that many of the facial characters could be directly correlated with the size of the teeth and teeth arches. He referred to the work of Ramsay Smith and Turner on the teeth and quoted from an unpublished thesis by Mr. Campbell, of Adelaide, that the incisors were rarely shovel shaped (Hodlicka) and said that this coincided with his own experience. It was well known that the aboriginal was megadont and that his teeth exhibited very frequently an extreme degree of wear, only small remnants of enamel being found sometimes even on the third molar teeth. The broad nose with small sunken nasal bones and anthropoid or simian gutter-like entrance to the floor of the nose was also a common feature, though other types were present. Dr. Burkitt held that many of the bony features at the entrance to the nose could be correlated with the direction and size of the incisor and canine teeth or at least partly so. The skull capacity averaged a figure in the vicinity of 1,270 cubic centimetres and Dr. Burkitt drew attention to what he believed were difficulties involved in Professor Griffith Taylor's attempts to trace racial evolution largely by means of the cephalic index. Thus, the Tasmanians had a cephalic index not far removed from West Scottish skulls, but had an average cranial capacity of 1,235 cubic centimetres. This was only approached by the Scottish skull in a large series, the remainder having a cranial capacity in the region of 1,400 or more cubic centimetres. The Tasmanians had a broader head than the Australasians, but had a smaller average cranial capacity. Although of little significance in an individual, it would probably have some significance in a race. Dr. Burkitt referred to the work of Duckworth and Flashman on the brain and showed several of the latter's specimens in order to illustrate the frequent development of the *sulcus lunatus* (Elliott Smith) with definite operculation. This sulcus was believed to be a definite primitive feature, such as occurred in the higher monkeys and anthropoid apes. In regard to the facial muscles he said that with Dr. Lightoller he had been studying these. So far their results indicated a coarseness of almost the whole of the facial muscles with less differentiation and a tendency for the big muscles to run into one another. The *quadratus labii superioris* muscle extended right down to the red margin of the lip; in the European it only extended to the naso-labial groove. The corresponding muscle in the lower lip was very extensive. This condition, while not peculiar to the aboriginal, probably reached its extreme development in him. Another feature which might only represent a chance variation, was the presence of a remarkably well developed offshoot of the *orbicularis oculi* muscle. This muscle, named by them the oculo-buccal muscle, accentuated and lay in the heavy fold of skin which extended from the side of the nose to the cheek. It was a characteristic feature of the aboriginal, though it was to be seen in other races. Dr. Burkitt emphasized the paucity of knowledge on general physical features and measurements and laid stress on the need for remedying this defect. In conclusion he demonstrated the Talgai skull and drew attention to the evidence for the interlocking of the canine teeth.

DR. A. C. HADDON, F.R.S. (Great Britain), the President of the Section, in discussing Dr. Burkitt's paper, asked whether the heavy supra-orbital ridges could be considered as an expression of racial senility as suggested by Keith. Parallel instances occurred in the lower animals.

DR. R. H. PULLEINE suggested that the teeth and facial skeleton of the natives of the coast should be compared with those of the interior as there was a definite difference in their food. More especially was this the case with the children. He also referred to the effect of posture on the tibiæ and finally pointed out the great value of Ooldea on the trans-continental railway line as a possible centre for a field anthropometric station.

DR. P. H. BUCK, D.S.O. (New Zealand), spoke of the necessity of undertaking further measurements in addition to those already in use for the purpose of revealing Mendelian characters in a race. He said that the Maoris were willing to allow studies of their burial caves so long as skulls were not removed.

MR. GULLBERG emphasized the necessity for the adoption of a uniform standard in measurements.

MR. KENYON remarked on the dome-shaped character of the skull and the wide variations that occurred in the skull generally. He did not consider the long bones to be so variable. The teeth in the aboriginal had been worn down to the dentine before the age of twenty-five years in the days before the advent of the white man. After this had occurred the pain of eating was considerable.

DR. BURKITT in reply said that possibly the supra-orbital tori were in part related to racial senile changes. There were several factors to be considered in their formation. These were the sex factor in the glabella region, the masticatory factor laterally, the effect of the temporal muscle and most important of all the relation of cranial contents to orbital contents. He agreed with Mr. Kenyon's remarks in regard to skull variation, but did not think this was as great as in Europeans. Berry had shown this statistically and his own experience tended to corroborate it.

Comparative Iso-Agglutinin Index of Australian Aborigines and Australians.

DR. A. H. TEBBUTT, D.S.O., read a paper before the Section of Anthropology and Ethnology on August 27, 1923, entitled "Second Report on the Comparative Iso-Agglutinin Index of Australian Aborigines and Australians." He said that in a previous communication (THE MEDICAL JOURNAL OF AUSTRALIA, February 25, 1922) he and Miss McConnel had reviewed the historical aspect of researches on human hæmaglutinogens and had emphasized the important fact that these characters of human red blood corpuscles were inherited according to Mendel's laws. There were two dominants and two recessives, the dominants being the "presence of" these corpuscular characters of Group II. and Group III. respectively and the recessives being the "absence of" these characters. These were therefore two allelomorphic pairs of Mendelian characters. The relative proportion of the Group II. dominant (A) to the Group III. dominant (B) in a race had been called by L. and H. Hirschfeld the bio-chemical index. DR. Tebbutt suggested that a more concise word would be the iso-agglutinin index. The Hirschfelds had worked out an approximate index for a large number of diverse races and had been able to divide man into three main groups which they had called the European (index 4.5 to 2.6), the intermediate (index 1.5 to 1.3) and the Asio-Afric types (index 1 to 0.5). The A dominant diminished and the B dominant increased in eastern as compared with western Europe and the latter dominant reached its maximum in India and diminished again in Indo-China. The intermediate type was represented by the Arabs, Turks, Russians and Jews (mainly from Monastir). The iso-agglutinin index would remain fixed in any particular race as long as there was no immigration of people with a different index.

Dr. Tebbutt then showed Table I. embodying the results of an examination of 1,176 Australians whose index was approximately 3.8. He elaborated the results of examination by similar methods of aborigines in New South Wales and Queensland (Tables II. and III.). The Queensland figures had been obtained from aborigines from all parts of the State. Of those whose place of origin could be ascertained, thirty-nine had been born in Cape York Peninsula or along the Gulf of Carpentaria, twenty-one had been born in north Queensland south and east of the first mentioned group, thirty-six had been born in central and fifty-three in southern Queensland. The index for all full blooded aborigines examined in New South Wales and

Queensland (the vast majority had been from the latter State) was approximately 5.7. This further work, although the figures were admittedly small, enabled him to predict with some confidence that the Australian aborigines would be found to be of the European type and probably of a more western type than even the English. In regard to the races that lay between Asia and Australia and the races of the Pacific he had seen figures for some Chinese (Liu and Wang, *The National Medical Journal of China*, 1920, VI., 118) which indicated that the index was 0.79. It was very interesting to note that the index obtained for some Filipinos by Cabrera and Wade was as low as 0.76 (*Journal of the Philippine Islands Medical Association*, 1921, I., 100). He was also able to say that Dr. G. M. Heydon was beginning to find that the natives around Rabaul had a Group III. incidence definitely higher than Australian aborigines. Dr. Heydon's work was incomplete and had not yet been published. There was apparently no information to hand concerning the peoples of Polynesia or the Maoris. Dr. Tebbutt said in conclusion that it could not be denied that the examination of a physical character of man which was inherited along Mendelian lines, was of great importance to anthropologists and the evidence obtained should be carefully examined by them. It was highly desirable that further races should be examined and that the figures already obtained for some races should be critically examined in the light of further examinations. He expressed his gratitude to the Walter and Eliza Hall Trust for sharing the expenses of the research and to Mr. Blakely, Chief Protector of Aborigines in Queensland, and Matron Little, of Barambah Settlement, Queensland, for their assistance.

TABLE I.

BLOOD GROUPS IN AUSTRALIA.—VARIATIONS IN SUCCESSIVE HUNDREDS.

Series of Persons	Groups.			
	I.	II.	III.	IV.
1 to 100	60	31	4	5
101 to 200	54	32	8	6
201 to 300	46	38	11	5
301 to 400	47	41	9	3
401 to 500	49	45	3	3
501 to 600	47	38	13	2
601 to 700	56	35	6	3
701 to 800	65	30	5	0
801 to 900	50	41	8	1
901 to 1,000	58	31	7	4
1,000 to 1,100	57	36	5	2
Average for 1,176 Australians ..	52.64	36.82	7.48	3.06

Group I. varies from 65 to 46; Group II. from 45 to 30; Group II. from 13 to 3 and Group IV. from 6 to 0.
Iso-agglutinin index approximately 3.8.

TABLE II.

NEW SOUTH WALES ABORIGINES (ALL CASTES).—SHOWING DISTRIBUTION OF GROUPS ACCORDING TO CASTES.

Aborigines	Group (Jansky).				Totals.
	I.	II.	III.	IV.	
Full-blooded ..	6	7	0	1	14
Three-quarter caste	19	12	2	1	34
Half-caste	66	42	3	0	111
One-quarter caste	17	13	3	0	33
Totals	108	74	8	2	192
Percentages ..	56.25	38.54	4.17	1.04	100

TABLE III.

BLOOD GROUPS IN AUSTRALIAN ABORIGINES (FULL BLOODS).—COMPRISING FOURTEEN IN SOUTHERN NEW SOUTH WALES AND ONE HUNDRED AND SEVENTY-SEVEN IN QUEENSLAND.

State.	Group (Jansky).				Totals.
	I.	II.	III.	IV.	
New South Wales	6	7	0	1	14
Queensland ..	99	66	11	1	177
Totals	105	73	11	2	191
Percentages ..	54.97	38.22	5.76	1.05	100

Bio-chemical index (iso-agglutinin index) = 5.7. Compare with index for English (Hirschfeld) = 4.5 and for Australians (Tebbutt) = 3.8.

DR. A. C. HADDON, F.R.S., the President of the Section, said that the method of examination was a new one, but might prove to be of great value.

DR. BURKITT discussed Mendelian characters in man. He said that Dr. Tebbutt's paper was almost the first attempt at what might be called "Mendelian dissection" in the races of mankind. He believed that cranial, dental and hair characters would ultimately allow of similar treatment. Almost the only other normal trait shown to be Mendelian in character was colour of the iris.

DR. TEBBUTT replied briefly that it seemed certain that amongst races in Asia and Africa there was a preponderance of the Group III. character, whereas in western Europe and in Australia there was a predominance of the Group II. character. It was probable that a gradual falling off of the Group II. character would be found in the islands between Australia and Asia, in much the same way as the intermediate type was to be found in eastern Europe and Asia Minor.

Coordination of Scientific Work in the Pacific.

A GENERAL discussion for members of the Congress as a whole was held on August 28, 1923, on the subject of "Organization and Coordination of Scientific Work in the Pacific Region." PROFESSOR SIR T. W. EDGEWORTH DAVID, F.R.S., occupied the chair.

It must be admitted that the idea of holding discussions in which all members of a congress may take part, is an excellent one. The consideration of large and important subjects from many points of view should be productive of good results. Much, however, must depend on whether the speakers keep to the subject under discussion and whether the chairman does or does not allow them to wander on in excess of their time limit. The time assigned for this discussion was two and a half hours. The set speakers were allowed in all eighty-five minutes. This meant that sixty-five minutes ought to have been available for general discussion. To begin with the meeting started a quarter of an hour late. Having started many of the speakers talked in an interesting fashion about their pet subjects but left severely alone all reference to organization and coordination. In fact the statement by one speaker that he intended to keep to the object of the discussion was greeted by suppressed mirth. Not only this, but all and sundry were allowed to exceed their time limit. The inevitable result was that at the end of the morning no time whatever remained for general discussion. It would be well to remember this in forthcoming congresses.

PROFESSOR H. E. GREGORY (United States of America, Section of Geography) in opening the discussion said that the time had come when scientists had some standing in the world. They recognized their responsibility of leadership and it was, therefore, necessary to consider the scope

of their work in order to render larger service with less effort and cost. Progress might be said to be due largely to a change in methods. The Congress and what it represented constituted an illustration of the new methods of attacking fundamental scientific problems. The method of working in isolation had been tried and found unsatisfactory. The human race contained merely a handful of people who were suited for work in isolation. It was safe to say that scientists who by themselves could do great things, could be numbered by the hundreds instead of by the ten thousands. It was, therefore, necessary to develope people of lesser grade. He referred to the activities of the National Research Council of the United States of America. He was convinced that success in science depended more on co-operation than on anything else. It had been necessary to pool the brains of the United States during the war. With this object the National Research Council had been formed. It had been thought that the National Research Council would cease to exist at the end of the war. Leading men had said no, because the problems of peace and war were alike, though different in motive and speed. The National Research Council was a non-governmental body and was supported by contributions from all over the United States. He believed that the method was a good one. The elements of cooperation were the existence of a plan and personnel together with funds and the will to cooperate. The personnel was a difficult problem. There were not enough people of the research calibre. It was necessary for the universities to take the problem to heart. Funds were the least difficult part of the problem. He said that he had yet to see a project strongly backed by a group of unselfish scientists that could not be financed. The will to cooperate was the essential part. It was remarkable how easy it was to find reasons for not cooperating. It was a revision of the code of ethics that was needed. The principle of service should be emphasized instead of priority and credit. No scientific institution or university could possibly follow out all the lines of research. Each must consider its scope and concentrate on the point best suited to it. If museums were to cooperate, they would have to change their coats from black to white. As a rule everything went into a museum and little came out. He held that the Bishop Museum with which he was connected, had no right to accept a gift of specimens from South Africa if the acceptance of the gift lessened the opportunity of studying South African problems in South Africa. It was necessary for individuals to adopt this outlook.

PROFESSOR E. C. STAKMAN (United States of America, Section of Agriculture), drew attention to the methods of soil surveys and to their value in regard to animals and crops. He said that it was necessary to carry out meteorological surveys in conjunction with soil surveys. He thought that the Congress might move in the direction of establishing a bureau for the dissemination of scientific information in the Pacific.

DR. E. D. MERRILL (Philippine Islands, Section of Botany) gave an account of the work and coordinated efforts of the Bureau of Science at Manila.

DR. J. H. L. CUMPSTON (Section of Hygiene) said that whatever scientific research was undertaken in the Pacific should have as its primary objective an increase in the sum total of the mental and physical welfare of living humanity. The Section of Anthropology had declared that the native races were dying out and Professor Martin had stated that hygiene could only operate in the presence of established routine. He protested that this did not represent accurately the position. It was not necessary to wait for the abolition of tribal *vendettas* before requiring the medical inspection of ships to exclude measles and influenza which killed thousands of natives. Nor was it necessary to wait for the stabilization of marriage customs before undertaking the treatment of yaws. Furthermore, in regard to hygiene, it was not so much research to discover new basic principles that was required as the determination and correlation of the local variations from established laws. Three things were necessary. Firstly it was essential that there should be available a sufficient number of medical men trained in tropical diseases. Secondly it was necessary that these medical men should have laboratories and other equipment at strategic points in the island groups and lastly there must be cordial harmony between the several nations in regard to both purpose and method. Money was necessary, but an annual expenditure for five years of £30,000 by each of the four great nations, England, America, France and Japan and by the two dominions, Australia and New Zealand, would be more than sufficient to cover the needs of the situation. The Australian Institute of Tropical Medicine was ideally placed as a coordinating base.

Among the others who spoke were: DR. A. C. HADDON, F.R.S. (Great Britain), Section of Anthropology; COLONEL SIR GERALD LENOX-CONYNGHAM, F.R.S. (Great Britain), Section of Geodesy; DR. C. A. BRAAK (Dutch East Indies), Section of Geophysics; DR. T. WAYLAND VAUGHAN (United States of America), Section of Geology; DR. C. M. FRASER (Canada), Section of Zoology; and DR. S. YOUNGBERG (Philippine Islands), Section of Veterinary Science.

Final Meeting.

AT the final meeting of the Congress an invitation was given by DR. JOJI SAKURAI on behalf of the Imperial Japanese Government to the members of Congress to hold the next meeting of 1926 in Japan. The invitation was formally accepted.

Among the resolutions passed by the Congress was that which had been passed by the Section of Hygiene in Melbourne and confirmed by the Section of Hygiene in Sydney.

British Medical Association News.

NOMINATIONS AND ELECTIONS.

THE undermentioned has been nominated for election as a member of the New South Wales Branch of the British Medical Association:

SHEPPARD, PHILIP ALBERT EDWARD, M.D., Harvard Univ., Mass., 1910; D.P.H., Lincoln Jefferson Univ., Ill., 1919 (Registered in N.S.W., 1923); c.o. C. A. Murray, Esq., "Kootra," Queen Street, Ashfield.

THE undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

BOYD, ARCHIBALD SPROTT, M.B., Ch.M., 1922 (Univ. Sydney), Royal Alexandra Hospital for Children, Camperdown.

EDWARDS, ALFRED THEOPHILUS, M.B., 1922 (Univ. Sydney), The Hospital, Callan Park.

FORSYTH, GORDON, M.B., Ch.M., 1922 (Univ. Sydney), Bundock Street, Coogee.

HOPE, ELSIE JOAN, M.B., 1922 (Univ. Sydney), Holborrow Street, Croydon.

JENKINS, ARCHIBALD, M.B., Ch.M., 1923 (Univ. Sydney), 14, Oxley Street, Glebe Point.

SINCLAIR, JAMES, M.B., Ch.M., 1920 (Univ. Sydney), Wentworth Falls.

THE undermentioned have been elected members of the Victorian Branch of the British Medical Association:

ANDREWS, HOWARD LYELL, M.B., B.S., 1923 (Univ. Melbourne), Kooweerup.

DAVIDSON, GEORGE RONALD, M.B., B.S., 1923 (Univ. Melbourne), East Malvern.

DAY, FREDERICK ARTHUR, M.B. *et* Ch.M., 1889 (Edin.), Whittlesea.

KELLAWAY, CHARLES HALLILEY, M.B., *et* Ch.B., 1911 (Univ. Melbourne), Melbourne Hospital.

SMALL, RONALD HERBERT, M.B., B.S., 1923 (Univ. Melbourne), Alfred Hospital, Prahran.

Correspondence.

THE WASSERMANN REACTION.

SIR: Dr. Tebbutt's reply (THE MEDICAL JOURNAL OF AUSTRALIA, August 4, 1923, page 132) to my criticism of his letter on the Wassermann reaction in secondary syphilis evidences a lack of appreciation of the points raised by me which is likely to create a wrong impression in the minds of your readers. Would you, therefore, kindly allow me space to reply in order that the position may be made clear.

My criticism was levelled against Dr. Tebbutt's premiss that with the use of a cold fixation method of technique, a reaction to the Wassermann test is a *sine qua non* of secondary syphilis. In his reply Dr. Tebbutt refrains from commenting on this—my main argument—and endeavours to cloud the issue by quoting Noguchi to show that a distinction exists between Wassermann substance and syphilitic immune body. As this fact was brought home to me many months ago as a result of my own investigations and as there was nothing in my criticism to indicate that I consider such distinction does not exist, Dr. Tebbutt's quotation was unnecessary and his inference misleading.

A reaction to the test indicates a change in the serum which we ascribe to the presence of so-called Wassermann substance. This latter is generally thought to occur as a by-product of the process of disintegration resulting from the fight between body tissues and spironema. In other words, there must be some immunological response on the part of the tissues to repel the invasion before the Wassermann substance appears in the blood. Hence my statement that "when the body is unable to marshall its defensive forces there is no Wassermann substance formed because of the failure on the part of the tissues to react to the invasion."

My experience with the Wassermann reaction has led me to the conclusion that while syphilitic immune body *qua* immune body is not responsible for the reaction, some degree of immunological response is necessary for the production of Wassermann substance and further that as immune body increases, so up to a point is there a coincident increase in Wassermann substance.

From Dr. Molesworth's report it was obvious that his patient lacked immunological response; hence my deduction that in this instance the failure to react in the test was due to a lack of response on the part of the tissues to react against the invading organism.

Dr. Tebbutt further accuses me of making illogical statements. After reiterating in his second commnication the immutability of his previously expressed view, *videlicet* that in this particular instance the patient either did not have syphilis or the reaction was missed through failure to utilize the cold fixation method, Dr. Tebbutt proceeds to state that he concedes my point that the reaction may have been missed through failure to adopt the technique to variation in the fixability of complement. *Verbum sapienti !*

Yours, etc.,

C. H. SHEARMAN.

26 College Street, Sydney,
August 20, 1923.

Obituary.

WILLIAM LEWIS AITKEN.

THE hand of death, ever busy, was recently laid on another member of the medical profession in Victoria in the person of William Lewis Aitken.

William Lewis Aitken was fifty-four years of age, having been born at "Langi Willi," Skipton, on April 23, 1869. He was educated at Scotch College, Melbourne, and in due course proceeded to the Melbourne University whence he graduated as M.B., B.S., in the year 1893. His first appointment was that of resident medical officer at the Children's Hospital, Carlton, an office which he filled so creditably that he had little difficulty in securing a similar appointment at the Women's Hospital.

At this stage of his career William Lewis Aitken visited England where he pursued post-graduate study. He returned to Australia in 1900 and almost immediately took up his residence in Stawell, the town in which he subsequently became so well known and highly respected. For a period of five years he held the position of resident surgeon at the Stawell Hospital and from 1905 to 1917 was settled in private practice at Stawell. He then purchased a practice at Charlton in which centre he had resided for three years when a very serious illness compelled him to retire from practice for twelve months. His former friends at Stawell induced him to return to the Stawell Hospital as resident surgeon, but ill-health again obliged him to retire after he had served two years in that capacity. Since that time he lived quietly in Melbourne until the time of his death.

William Lewis Aitken was an outstanding figure, of fine physique and strong moral influence. Of retiring disposition he avoided publicity, but at the same time his scrupulous conscientiousness in the discharge of his professional duties sustained him in very high repute.

He was very jealous of the honour of his profession and in his practice observed rigidly very high ideals of ethics. The poor of his district never turned to William Aitken in vain and he drove many long miles to carry relief to patients from whom there was no prospect of recompense.

He took a keen delight in his garden in which splendid results rewarded him for the labour he bestowed upon it.

While resident in Stawell, William Aitken was a member of the Committee of the Stawell Hospital and interested himself actively in the administration and progress of that institution.

Proceedings of the Australian Medical Boards.

NEW SOUTH WALES.

THE following have been registered, under the provisions of the *Medical Act, 1912 and 1915*, as duly qualified medical practitioners:

COOKE, EDITH ELIZABETH ALICE, M.B., Ch.M., 1920 (Univ. Birmingham), now ANDERSON, EDITH ELIZABETH ALICE, Double Bay.

KILLMIER, ERNEST RAYMOND, M.B., Bac. Surg., 1923 (Univ. Melbourne), 32, Cavendish Street, Stanmore.

MCCOY, HAROLD ALEXANDER, M.B., Ch.M., 1922 (Univ. Sydney), England.

SHEPPARD, PHILIP ALBERT EDWARD (registered under section IV. (2) of the Medical Practitioners Act, 1912), Ashfield.

TIGHE, THOMAS PATRICK, M.B., Bac. Surg., 1920 (Univ. Melbourne), Albury.

VICTORIA.

THE following have been registered, under the provisions of the *Medical Act, 1915*, as duly qualified medical practitioners:

NIESCHE, FREDERICK WESTWOOD, M.B., B.S., 1923 (Melb.), 64, Tivoli Road, South Yarra.

WATSON, HENRY, M.B. *et* Ch.B., 1902 (Aberdeen), "Biltmore," Eildon Road, St. Kilda.

Additional Qualifications Registered.

BELL, JAMES RIDDELL, M.R.C.P., 1921 (Lond.).

HISLOP, JAMES GORDON, M.R.C.P., 1922 (Lond.).

Names of Deceased Practitioners Removed from the Register.

ROLLASON, ABEL.

SHOWMAN, LOUIS FREDERICK.

FINNIS, JOHN HENRY SUFFIELD.

Books Received.

ENDOCRINE DISEASES INCLUDING THEIR DIAGNOSIS AND TREATMENT, by Wilhelm Falta, Vienna, Translated and Edited by Milton K. Meyers, M.D., with a Foreword by Sir Archibald E. Garrod, K.C.M.G., M.D. (Oxon.), F.R.C.P. (London), F.R.S.; Third Edition; 1923. Philadelphia: P. Blakiston's Son and Company; Sydney: Angus and Robertson, Limited; Crown 4to., pp. 690, with 104 illustrations in the text. Price: 42s. net.

THE EFFECTS OF RADIUM UPON LIVING TISSUES: WITH SPECIAL REFERENCE TO ITS USE IN THE TREATMENT OF MALIGNANT DISEASE (JACKSONIAN ESSAY), by Sidney Forsdike, M.D., B.S. (Lond.), F.R.C.S. (Eng.); 1923. London: H. K. Lewis and Company, Limited; Demy 8vo., pp. 72, with nine plates containing 42 illustrations. Price: 5s. net.

HYGIENE AND PUBLIC HEALTH, by Louis C. Parkes, M.D., D.P.H. (Univ. of London), Lieutenant-Colonel R.A.M.C. (Temp.) and Henry R. Kenwood, C.M.G., M.B., F.R.S. (Edin.), D.P.H. (Lond.); Seventh Edition; 1923. London: H. K. Lewis and Company, Limited; Demy 8vo., pp. 794, with 90 illustrations. Price: 20s. net.

HODGKIN'S DISEASE, by R. Allan Bennett, M.D. (Lond.), M.R.C.P.; 1923. Bristol: John Wright and Sons, Limited; Crown 8vo., limp cover, pp. 56. Price: 2s. net.

MY LIFE AND WORK, by Henry Ford, in collaboration with Samuel Crowther; First Australian Edition; 1923. Sydney: Angus and Robertson, Limtied; Crown 8vo., pp. 291. Price: 7s. 6d. net.

COLONIC AND DUODENAL LAVAGE: WITH A SUGGESTED IMPROVEMENT IN THE PLOMBIÈRES TREATMENT, by Captain J. T. Ainslie Walker, R.A.M.C. (T.F.); 1923. London: H. K. Lewis and Company, Limited; Crown 8vo., limp cover. Price: 1s. net.

RADIANT MOTHERHOOD: A BOOK FOR THOSE WHO ARE CREATING THE FUTURE, by Marie Carmichael Stopes; Second Edition; 1923. London: G. P. Putnam's Sons, Limited; Crown 8vo., pp. 246. Price: 6s. net.

Medical Appointments.

The undermentioned have been duly authorized by the Board of Health of New South Wales as Inspectors under section 50 of the *Cattle Slaughtering and Diseased Animals and Meat Act, 1902*: DR. D. CROMBIE (B.M.A.), at Tocumwal; DR. V. R. ELPHICK (B.M.A.), at Cargellico; DR. H. A. ANNETTS (B.M.A.), at Hillston; DR. J. Z. HUIE (B.M.A.), at Peak Hill; DR. J. R. LESLIE (B.M.A.), at Newcastle.

* * * *

The appointment of DR. STANLEY SEYMOUR ARGYLE (B.M.A.) as a Member of the Executive Council of the State of Victoria, has been gazetted.

* * * *

DR. F. M. SUCKLING (B.M.A.) has been appointed Assistant Medical Officer of Health, Office of the Director-General of Public Health, New South Wales.

* * * *

DR. PETER LALOR (B.M.A.) has been appointed Acting Superintendent of the Hospital for the Insane at Sunbury, Victoria.

* * * *

DR. JOHN RAMSAY (B.M.A.) has been appointed a Member of the Board of the Launceston Public Hospitals District.

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser," page xviii.

CENTRAL EYRE'S PENINSULAR, S.A.: Resident Medical Practitioner.

ROYAL HOSPITAL FOR WOMEN, PADDINGTON, SYDNEY: Vacancies for Post-Graduates.

HOSPITAL: Honorary Director of the Department Orthopædics and Special Therapeutics.

N'S (MATERNITY) HOME, ADELAIDE: Resident House n.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429, Strand, London, W.C.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 30 - 34, Elizabeth Street, Sydney	Australian Natives' Association Ashfield and District Friendly Societies' Dispensary Balmain United Friendly Societies' Dispensary Friendly Society Lodges at Casino Leichhardt and Petersham Dispensary Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney Marrickville United Friendly Societies' Dispensary North Sydney United Friendly Societies People's Prudential Benefit Society Phœnix Mutual Provident Society
VICTORIA: Honorary Secretary, Medical Society Hall, East Melbourne	All Institutes or Medical Dispensaries Australian Prudential Association Proprietary, Limited Mutual National Provident Club National Provident Association
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane	Brisbane United Friendly Society Institute Stannary Hills Hospital
SOUTH AUSTRALIA: Honorary Secretary, 12, North Terrace, Adelaide	Contract Practice Appointments at Renmark Contract Practice Appointments in South Australia
WESTERN AUSTRALIA: Honorary Secretary, Saint George's Terrace, Perth	All Contract Practice Appointments in Western Australia
NEW ZEALAND (WELLINGTON DIVISION): Honorary Secretary, Wellington	Friendly Society Lodges, Wellington, New Zealand

Diary for the Month.

SEP. 30.—Victorian Branch, B.M.A.: Election of two members to Federal Committee.
OCT. 1.—Victorian Branch, B.M.A.: Election of Representatives of Divisions.
OCT. 2.—New South Wales Branch, B.M.A.: Council (Quarterly).
OCT. 3.—Victorian Branch, B.M.A.: Branch.
OCT. 5.—New South Wales Branch, B.M.A.: Annual Meeting of Delegates of Local Associations with Council.
OCT. 5.—Queensland Branch, B.M.A.: Branch.
OCT. 6.—New South Wales Branch, B.M.A.: Annual Meeting of Delegates of Local Association with Council.
OCT. 9.—New South Wales Branch, B.M.A.: Ethics Committee.
OCT. 10.—Melbourne Pædiatric Society.
OCT. 10.—Western Australian Branch, B.M.A.: Council.
OCT. 12.—New South Wales Branch, B.M.A.: Clinical Meeting.
OCT. 12.—Queensland Branch, B.M.A.: Council.
OCT. 12.—South Australian Branch, B.M.A.: Council.
OCT. 16.—New South Wales Branch, B.M.A.: Executive and Finance Committee.

Editorial Notices.

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All communications should be addressed to "The Editor," THE MEDICAL JOURNAL OF AUSTRALIA, B.M.A. Building, 30-34, Elizabeth Street, Sydney. (Telephone: B. 4635.)

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